Municipal News and Water Works

PUBLISHED MONTHLY BY GILLETTE PUBLISHING COMPANY

CONKEY AVE. AND MADISON ST., HAMMOND, IND., AND 221 EAST 20TH ST., CHICAGO, ILL.

Publishers of
Engineering and Contracting — Road and Street Catalog and Data Book
Municipal News and Water Works — Water Works Catalog and Data Book
Roads and Streets — General Contractors' Catalog and Data Book

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Subscription Price $2.00 — Foreign Postage 65c Extra

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Vol. LXXV — SEPTEMBER, 1928 — No. 3

A Plea for Special Freight Rates on Road Show Exhibits

American railways have been asked to grant a special rate on equipment shipped for exhibition at the annual Road Show. We understand that certain railways have replied that special freight rates are prohibited under the scheduled tariffs approved by state and national railway commissions. Doubtless this is so, but it is equally certain that these commissions will approve any convention rates that the railways may submit. The commissions have never objected to the one-and-a-half passenger fares for round trips to conventions, because it is obvious that such special fares greatly encourage attendance at conventions.

Should it be argued that exhibitors need no such encouragement, the reply is that very few annual exhibitions of heavy machinery have been repeated many years, because of the great expense involved in transporting the machinery. The Road Show, it is true, has survived even this great burden for several years; but many a former exhibitor has dropped out of the picture, and many others annually ask themselves whether it will pay to attend again.

It should be remembered that the great annual Cement Show finally came to an end because of the expense involved, an expense that consisted very largely in shipping heavy machinery to and from the show.

The exhibits at the two annual waterworks conventions have been reduced in size until many exhibitors now show only models. This reduces the value of the shows and thus tends to decrease the number who attend them.

Not only will the railway companies lose income directly if the Road Show exhibits dwindle, and the attendance declines in consequence, but they will lose much more income indirectly, for the Road Show has been one of the greatest of educational institutions. It has taught thousands of men the value of labor-saving machinery, and has stimulated the development of highways. This, of course, has added greatly to the volume of freight hauled by railways.

There may still be a few short-sighted railway officials who regard paved roads as serious competitors, and who therefore would oppose granting special freight rates to exhibitors at road shows. But the majority of railway officials have come, we believe, to regard road transportation as supplementary to rail transportation, and no more to be dreaded than air-mail transportation.

Foreigners have often said that Americans are "convention crazy"; and we are seemingly so, for we attend exhibits and listen to essays and debates on all trade and professional subjects from the hatching of chicks to the discovering of stars. Those who ridicule us as "joiners" and "attenders" are not disparaging us as "producers," for we have outstripped every nation in productive capacity. Not the least of the reasons why we are envied as the wealthiest of peoples is our joining and attending habit. It is thus that we gain much of our knowledge, by swapping ideas and by seeing the latest in mechanical devices and materials.

There is, moreover, an inspiration in meeting men of whom you have heard, and even merely in seeing great crowds of men who are engaged in the same business that you follow. The joiner and attender goes home from a convention the richer not merely in new ideas, but in confidence that he is playing an important role himself in a great industry. All this stimulates him to keep out of the ruts, to read the literature and the advertisements relating to his specialty, to scrap the old and buy the new—to be a typical American. Because he is progressive, an American consumes far more rail-hauled produce than does the typical citizen of any other nation.

Granted? Then grant also that our American conventions have aided greatly in making us the greatest patrons of railways in the world.

"We Are Just Learning to Think"

According to a recent statement by the American Research Foundation:

"Science has made more advancement of benefit to man in the last thirty-five years than it did in all previous time—and time runs back millions of years. We are just learning to think."

Called by early evolutionists "the missing link" and by recent evolutionists "the dawn man," the ape-man probably emerged during the early Miocene period, or about 1,500,000 years ago. With crude weapons and tools made of stones, wood and fibres, the dawn-man began the study of the forces of nature. Imagine him now looking from a distant planet upon the modern fruits of his ancient effort!

In a true sense, man has been learning to think since he became man, some 75,000 generations ago, but his

thinking efficiency has increased in geometric ratio only since Guttenberg printed the first book, and that means since about the time that Columbus sailed into the uncharted west to reach India and prove that the earth is round.

Archimedes and a few other Greeks had learned how to interrogate Nature systematically, and had therefore founded modern science, nearly 20 centuries before the printing press was invented, but the rebirth of science did not occur until about the beginning of the 16th century. Then we see Galileo fashioning a little instrument made of spectacle lenses held in a tube, and looking with delight upon the four moons of Jupiter which epitomized the solar system for him and gave him renewed confidence in the heliocentric theory of the monk Copernicus. If any one moment is to be chosen as the birth date of modern science that is perhaps the moment. But, as a matter of fact, science has been evolving ever since man existed, for the present methods of science are merely elaborations of the first crude methods of learning how Nature acts. Eventually it may even be proved that the trap-door spider and the honey-bee are scientific thinkers too, and thus break down our thesis that man originated science.

A physical science is a comprehensive assemblage of facts, some of which are explained by theories, and some of which are shown to have relations expressed as laws.

The first discovered kinships between facts were merely qualitative likenesses, but as man began to master the science of numbers he began to find quantitative laws. It is this quantification that has caused the recent rapid strides of science, perhaps more than any other cause, except experimentation. There is a very remarkable feature about measured relationships in natural phenomena, namely, that where the same numerical factor is found in any two quantitative laws, there probably exists the same underlying form of energy in both phenomena. Thus the intensity of light and of magnetism both vary inversely as the square of the distance; and light has been found to be an electro-magnetic phenomenon. By the same token, gravitation and magnetism are probably much alike in nature.

It has been remarked that the last inventor who has availed himself of all the work of scores of predecessors, in producing a commercial success, is often unjustly given almost the entire credit for an achievement that he really should share with a hundred other men. Are we of today not likewise seizing more credit than belongs to us when our recent achievements lead us to say that in two generations we have accomplished more than was accomplished by all our forebears in 75,000 generations? Are we not flattering ourselves a wee too much when we say that man has just begun to think?

Were men not thinking when they first used a log as a roller upon which to transport heavy weights? Were they not thinking when they put an axle through two short logs and made the first pair of wheels? What were they doing when they learned to predict eclipses several thousand years ago? And what when they first smelted iron and pounded it into spears?

Would it not be truer to say that certain men have always thought in a somewhat scientific manner, but that only recently have many men been trained so to think? And that even yet, the number trained to discover and apply the laws of nature is pitifully few. Consider that only one American in about 1,000 has had a comprehensive course in science, and that of those so trained, probably not one in ten has been taught how to discover a principle or law of nature.

The power to think has been man's as far back as we are able to trace his acts. But the leisure to think, the means of readily finding what other men have thought, and the knowledge of the most effective methods of thinking—these are quite modern, and they are enabling us to sweep forward with achievements so varied and so startling as almost to persuade us that the ancients were not such stuff as we are made of.

H. P. Gillette

Space Reservations Open for Dallas Convention

Victor E. Arnold, chairman of the Exhibitors' Committee of the Water Works Manufacturers' Association, Inc., Room 1775, 50 Church St., New York City, is soliciting exhibits for the 17th annual convention of the Southwest Water Works Association, to be held in Dallas, Tex., from October 15 to 18. The convention will be held in the Baker Hotel. Local arrangemnts are being made by Hugh E. Moore, secretary, Water Department, Dallas.

It is understood that a number of manufacturers have already reserved space, and that the convention committee has worked up a very interesting program for the convention.

Iowa Town Sells Light Plant

At a special election, recently held in Irwin, Ia., it was voted to sell the town's light and power distribution plant to the Iowa Public Service Company and obtain power from that concern in the future. The company agreed to pay the town $20,000 for its distributing plant. In the past Irwin obtained power from the town of Manilla.

Safety Convention in October

The National Safety Council will hold its annual convention in New York City in October. It is expected to bring 6,000 delegates to the city for five days, it was announced recently by Lewis A. De Blois, chairman of the New York Safety Committee and former president of the council.

"It may not be generally known," said he, "but it is a fact that New York City loses $10,000,000 annually through street congestion. If accidents can be eliminated, congestion losses will be greatly reduced. During the Congress there will be a safety exhibit on the roof of the Pennsylvania Hotel."

Port Authorities to Meet in Houston

The American Association of Port Authorities will hold their 17th annual convention in the Rice Hotel, Houston, Tex., on November 12, 13 and 14. On November 15 the convention will adjourn to Galveston for an inspection trip. The program includes papers on many live subjects by recognized authorities in the field, together with a number of inspection trips, according to Tiley S. McChesney, secretary, 200 New Orleans Court Bldg., New Orleans, La.

New Books

Labor Costs on Construction, by Frank L. Conner; 202 pp., 5¼x8 in.; Fabricoid binding; Gillette Publishing Co., 221 E. 20th St., Chicago, publisher; Price $3.00.

Labor Costs on Construction, by Frank L. Connor, is a very valuable addition to the rapidly increasing list of data books for estimators and others whose work makes it necessary that they should possess a working knowledge of construction costs.

In reality, this book is very largely a digest of several other works on the same subject, yet it presents many of the data in such new groupings that an estimator should find them especially valuable when checking up an estimate or in estimating an item somewhat out of his regular run of work.

The chapters on timber work and rough and finish carpenter work are so sketchily written that they do not maintain the same standard of excellence that characterizes the majority of chapters, but this may be due to the fact that accurate costs of work in those classifications are difficult to obtain.

On the other hand, the chapters on excavation and painting are unusually complete and the information is presented in a helpful and useable manner.

For convenience in use, a slightly smaller page size might be a decided improvement but, everything considered, the book should prove a worthwhile addition to the library of every estimator and contractor.—**Charles F. Dingman.**

Street Maintenance Organization and Operation In a Small City

An Interesting Discussion of the Common Problems of Smaller Cities

By E. A. LAWVER
City Engineer, Fort Collins, Colo.

NO set rule can be laid down for the guidance of the officials of small cities for the care and maintenance of their streets. Each city has local problems for which the officials themselves must make their own rules. All of the smaller cities, however, have certain problems in common which, because of their certainty, have become axioms.

Difficulty of Securing Adequate Funds.—It has been said that the basis of all evil is money. This may or may not be true. Anyone who has had experience with street problems, does not have to be told that the basis of all street difficulties is lack of money. This is probably the only point on which street men ever whole-heartedly agree. If you are not a street man and doubt this truth, ask any salesman of road equipment what stands between him and unlimited prosperity and the answer will be stated briefly but sadly, in the tone of Poe's raven, "Lack of money. Never more."

No matter how much scheming is done or how much pressure is brought to bear, the budget which is allowed for streets is always short of the actual needs. What is the reason? One of the chief reasons is that the cost of street work cannot be definitely stated. In other words, if the cost of snow removal for the year would be $2,089.61 and road dragging would be $3,148.16, and so on through the regular routine, and if quotations and convincing figures were available, the amount of the budget would be much more easily obtained. Other departments, because of the certainty of their work, can come more nearly doing this. For example, the police department can itemize its probable expenditures to such a degree of exactness that the amount asked for incidentals is a minor item. The item of salary is clearcut, for this department knows a year in advance that a given number of patrolmen will be employed. It knows that a definite number of uniforms are to be purchased; that a new motorcycle will be bought, etc., and that the balance listed as incidentals will be ample for the purchase of gasoline, oil, flashlight batteries, and other small items. In general, the same thing is true of the fire department. In this department, the unexpected expenditures are a trifle higher, but nevertheless they are an insignificant percentage of the whole amount.

When the various tabulated budget requests are laid on the table before a committee that is to determine the tax levy and distribute the funds for the coming year, the indefinite compilations of the street department draw the fire of each and every member of the committee except the street department representative.

This committee usually has determined beforehand that taxes must be cut and the "strictest economy" must be practiced. Very often a definite number of mills has been arbitrarily decided upon in advance. As a result of this, almost the entire cut is taken by the street department.

It is for this reason that items for necessary equipment are often struck from a budget. Assume that a request is made for a 2 ton tractor costing $2,000 to replace flushers and trucks for dragging. The same preliminary budget contains an item of $2,500 for blading and dragging. In order to make a $1,000 cut, some wiseacre will say that in his opinion $1,500 is entirely enough for this purpose. And then after this amount has been agreed upon, some other wisehead will suggest that inasmuch as there is to be only $1,500 spent, it will do no harm to use the flushers and trucks as before. The item for a tractor is, therefore, eliminated and the smirk of "strict economy" settles over the group.

There are too many boards who seem to think that, merely by setting a figure like the $1,500 in the above illustration, the amount of work is predetermined. They seem to forget that no one has as yet found means of controlling the weather and that after each storm blading and dragging must be done. The same kind of tactics force the street department to wear out equipment on duties for which it was never designed. Did anyone ever see a fire truck used for dragging streets? No. It is not designed for that purpose! Neither is a flusher, but using one on a drag is common practice. I have seen $8,000 flushers worn out in half the usual time because some bright economy hound has lopped off an $1,800 tractor item.

A true, dyed-in-the-wool street man always has hopes (which will probably die with him) that some day this will be different. He won't always be compelled to hand a man a pitchfork and tell him to hoe weeds with it. The taxpayers are demanding more than ever before that their streets be improved and kept in tiptop shape, but at the same time they are crying for the low taxes which were collected when knee-deep mud was the style.

These are a few of the things which the street department men in a small city must overcome or, more strictly, with which they must contend in order to perform their tasks. This is the foundation on which first-class service is supposed to be based. Is it strange that the results are not always perfect?

Essentials of an Ideal Organization.—In further discussing the subject of street maintenance, organization and operation in the small cities, it will be assumed that the street department has at last been put on the same basis that any good business enjoys and that it is not hampered by inadequate funds or lack of equipment. By this neither an overbundance of equipment nor an unlimited budget is meant, but that there is just enough of each to perform the work economically and efficiently. Local conditions and size of city will determine to a considerable extent the kind of equipment needed as well as the size of various items in the budget.

The first essential of an efficient business is a well-balanced organization. The head of the department should be a man who is familiar with the business of streets. He should have had considerable experience in handling men and must be a person of sufficient tact to deal with the public without undue irritation. This man should supervise and not be expected to devote a great deal of his time to the details of the work. His entire time need not be devoted to the street department, hence he may also serve as city engineer or city manager.

The detail work should be in the hands of a street foreman who gives the work his full attention. It is his business to see that the work progresses smoothly and that it is done promptly and efficiently. This man, as well as the department head, must have the ability and experience to handle men, and he must be familiar with the various phases of street work and the equipment related thereto. The street foreman must see that the work within the department is handled properly

while the department head must look to the proper functioning of the department externally, particularly in its relationship with the public and the other departments.

The Personnel.—The personnel under the street foreman's immediate charge varies considerably with the time of year and the nature of the work. A few experienced men are employed the year around as a skeleton organization. These men, most of whom come "from the ranks," are classified as skilled laborers and mechanics. This group consists of one head mechanic whose duty it is to keep the equipment in good working order. He has complete authority over the equipment and is held responsible for its condition. This position requires a man well versed in gas engines and one with wide experience, for he has a variety of equipment in his charge.

The remainder of this group consists of truck drivers, mechanics, and teamsters who, aside from their regular vocations, must be able to use a lathe, do blacksmith work, welding, carpentering, blading, and other odd jobs. Above all, this group of men should not be the kind who hesitate when called upon to use picks, shovels, or other tools of the common laborers.

With this organization a vast amount of work can be done by merely adding unskilled labor when the necessity arises. Furthermore, the men comprising this organization can be kept at useful employment, such as overhauling equipment, during the winter months when the outside routine work is slack. Practically no repair work will be done in outside shops if the proper shop facilities are provided.

Equipment.—With reference to the kind of equipment and the amount of tools which the city should own, there is little to say except that there should be enough of the right kinds to produce economical and skillful results. These results cannot be accomplished by trying to use a pitchfork for a hoe nor by allowing the equipment and tools to be used without keeping them in good repair. It is necessary to obtain the right equipment for the particular job and see that this equipment is hitting on every cylinder all the time.

Every city should have a good shop of sufficient capacity for its needs. Plenty of light and heat are required if the mechanics are to work efficiently. The shop should have the various labor-saving devices commonly seen in the shop of any successful privately owned company. There should be a lathe and drill press, cutting and welding equipment, and other similar machinery. The city shop should be on a par with private shops in the city which are handling an equal amount of business. If it pays the private concern, it will surely pay the public.

The man who works for the city has the same pride in his work as the man who works in the private shop if he is given equally considerate treatment. The major part of the total cost of city work is labor and the small amount spent for better tools will greatly increase the output of the labor. Unfortunately, the shop of the smaller city is usually a mere hole or cave containing a few poor tools long since worn out. Too many city fathers are reluctant to improve these conditions, claiming they cannot afford to spend the amount needed for an up-to-date shop. This is a favorite item to be eliminated or reduced when some one has the audacity to mention it in the budget. Intentionally or otherwise, officials who trim this item are also trimming the public.

With a good shop as a start, the next thing to be considered is the equipment. The speaker is not going to mention the product of any particular manufacturer. There is much good equipment on the market from which to choose any particular machine. A standard brand of equipment should be selected. The suggestions of the foreman will probably be helpful. An inspection trip to see the machine in operation is extremely desirable. A talk with the operator when he is alone, and also with the mechanic who repairs the machine will be of assistance. A decision can be made much more intelligently after this information has been obtained.

Street Maintenance. — Inasmuch as the bulk of street work in smaller cities is maintenance after storms, that phase will be considered first. The smaller cities, as a rule, have the majority of street surfaces unimproved. It is these streets which require the greater amount of attention. If the soil is naturally sandy, the city is fortunate, but if the soil is adobe or clay then there is a real job for somebody. Under the latter conditions, there must be considerably more equipment and the task, in addition to being more difficult, must be performed in a shorter length of time. The rapidity with which a street is put in shape after a storm will depend largely on the condition of the street before the storm. If the best results are to be secured, a clay or adobe soil must be prepared for the next storm while the moisture of a preceding storm is still very much in evidence. This soil should be worked with light continuous tread tractors and medium weight drags while it is still possible to obtain a puddling effect. The ruts should be filled with sticky mud which is glazed over by the sliding action of the drag, thereby producing a surface which will be more nearly impervious and consequently more difficult to rut.

Blades which are drawn by continuous tread tractors should follow the drags. New gutters should be cut and the distorted crowns should be worked into shape. This work should be done before the soil has crusted and while it is still possible for the moved material to bond with the undisturbed portion. After this treatment, the streets should be let alone until after the next storm.

If an attempt is made to shape clay streets after they have dried, the result will be an abundance of dust or loose clods easily whipped out of the ruts and a soft, impassable roadway as soon as a storm sets in.

In the writer's opinion, a truck is not suitable for this class of work. It is in this soil, particularly, that the truck which is used for dragging is most abused. If the truck is put to work when the soil is in the proper condition to give the best results, it cannot get traction and succeeds only in cutting enormous ruts unless it is so fortunate as to immediately bury itself to the hubs. When the soil has dried sufficiently to permit traction, a drag will only bounce over the surface. In either case little has been accomplished.

It is understood that the above remarks apply to heavy soils. By heavy soils is meant clays and adobes which are practically devoid of grit. This is the kind of earth that made the sugar beat famous because the sugar beet thrives in it, but such soil is not suitable for road material.

As has been said before, it is utterly impossible to state definitely the number of the various machines or pieces of equipment necessary for a small city, for there are too many variable conditions. To illustrate: It is very seldom that the speaker does not hear this or similar remarks when he mentions that he is from Fort Collins: "Oh, yes! I remember it. It is the city with such nice wide streets." Fort Collins is proud of its wide streets; but it must pay a price for this luxury.

Wide streets cost more to maintain than the narrow ones. Unfortunately, the cost of street maintenance is proportional to the square yard of surface instead of to the linear foot of street. Also, a wide street in muddy weather gives each vehicle a chance to make a new rut. A half dozen autos on a wide street in a residential district can cause considerably more maintenance than a constant stream of cars on a narrow thoroughfare. The reason is apparent. Many cars will smooth out and pack the soil if they are held within narrow limits; while a few cars, when given a broad street on which to travel, leave a corresponding number of miniature canyons.

A drag or blade is limited in size by the power which pulls it. A wide street may require six or eight trips to cover its area, while a narrow one is often covered in three trips. As time is the important element in street dragging, much more equipment must be at work simultaneously on wide streets than on the narrow ones even though the mileage of streets is the same. An increase of equipment means

an increase of men, gasoline consumption, and other expenses.

Then, too, wide streets discourage improvement because the cost is greater than for similar work on narrow streets. The result is that they continue to be muddy streets for a long time after the narrow ones are paved.

Graveled streets help to increase the length of time in which streets can be effectively maintained because they drain and dry much faster than do the clay type. This permits the equipment to be at work much sooner after a storm than if all the streets were of clay. Also, they can be worked after they are dry with less harmful effect. This is especially true if the gravel on the surface is moderately fine. However, the most permanent results are secured while the surface is quite wet.

The tractors used in dragging and blading have many other uses in city work. One of the most important uses is in connection with snow removal. There is no better equipment than the tractor for clearing the roadways and windrowing the snow. It can be used also as a stationary power plant for running gravel screens and crushers and for other similar purposes. There will be few days in the year when the tractor is not put to some good use.

Every street department should be well supplied with small 1½ or 2 yard dump trucks. These are low in first cost, the upkeep is small, and they can be used efficiently at all times of the year. While they are somewhat too small for bulky snow, still they dump easily and move rapidly and are, after all, very economical for this purpose. During all times of the year they can be kept busy hauling trash and rubbish. If there is dirt to move, or gravel to spread, the city-owned fleet can be relieved temporarily of its other duties. Any city which has not tried this method of hauling is still in the horse and buggy stage.

Snow Removal.—In street work in this climate, it may be necessary to sprinkle dusty streets industriously today and to shovel snow tomorrow. Of all the uncertain yet costly jobs that fall to the street department, snow removal is the worst. Within the last few years there has been an ever increasing demand to keep the business streets in the small cities cleared of ice and snow. There is not enough snow in this part of the state to warrant the use of snow loaders. In localities where snow falls often and to considerable depth, loaders are a necessity. All snow should be removed as quickly as possible during the time of year that it melts slowly. Snow should be removed first from the shady side of the streets. Extra men should be hired and all tractors and trucks should be put to work. It is important to remove the snow as quickly as possible because it may quickly turn to ice and the cost of removal is thereby greatly increased.

During the winter, the mud which drops from parked cars really causes more trouble in cleaning than any other one thing. The big cities are not troubled to the extent that the small cities are, because most of their streets are improved and are, therefore, not mud producers. The small city, however, has to contend not only with the city cars traveling over muddy residential streets to the business district, but with cars which go from the country roads to the heart of the city. The mud which falls to the pavement in a half frozen condition quickly adheres to it. It is almost impossible to remove this mud while the cold winter weather continues, consequently the mud may accumulate until the first warm weather of spring approaches. During the daytime, the surface of this mud will melt, causing a decidedly unkempt appearance as well as a muddy street.

The real street supervisor always has an eye on this mud and at the first sign of a thaw his gangs are hard at work with crowbar and shovel. During this season of the year, much may be heard about the inefficiency of the street department.

Street Cleaning.—The business streets during the rest of the year are readily kept clean if parking is prohibited at certain hours of the night. All cities with sufficient pavement should own a motor driven flusher and sprinkler. A pick-up broom, while not an absolute necessity, will quickly pay for itself during certain times of the year. It is believed that a street in the business district can be cleaned better and quicker by a flusher than by a motor driven pick-up sweeper, but when cold weather comes, the flusher cannot be used and the sweeper is invaluable. All cleaning in the business district should be done at night with the exception of the work of the push-cart patrol. Occasionally, during the winter, a flusher can be used in the middle of the day to wash the center portions of the streets. Much care must be exercised when this is being done to prevent motorists and pedestrians from being spattered.

The pick-up broom can be used during the daytime on the improved residential streets when they are dry. The type of machine with a good gutter broom is invaluable when the leaves are falling. Dump trucks should carry away the rubbish as fast as it is collected by the sweepers. The speaker knows of no better way to handle the leaf problem.

The speaker believes that he has touched on most of the items of importance in street maintenance organization and operation in a small city.

Nothing has been said about the maintenance of paving. The speaker is not qualified to speak on any kind of paving maintenance other than concrete and there is little of that to be done in Fort Collins. Fort Collins has 285,000 sq. yd. of concrete paving, but maintenance is included in minor items of the budget. To say anything more about the maintenance of gravel streets would probably not add much to this discussion. Street maintenance and operation are questions which are likely to bring out interesting discussion which will probably add to the fund of available knowledge on this subject.

Acknowledgment.—The above paper was presented at the 1928 Highway Conference at the University of Colorado.

City Officials Organize Division of American Road Builders Association

Capt. H. C. Whitehurst, assistant to the engineer commissioner of the District of Columbia, was elected president of the City Officials' Division of the American Road Builders' Association at the organization meeting held June 8.

The new division adopted a constitution and formulated plans for carrying out the objectives for which the division was organized. Chairmen of four major committees were subsequently appointed. Captain Whitehurst heads the Committee on Administration and Organization; George B. Sowers, Cleveland, the Committee on Design and Construction; C. E. Myers, Philadelphia, the Committee on Maintenance; and M. O. Eldridge, Washington, the Committee on Traffic. Each of these committees will have various sub-committees.

Twenty-four states were represented at the session. Charles M. Upham acted as temporary chairman. Col. R. Keith Compton, chairman of the Richmond, Va., Department of Public Works, addressed the assembly. He told of the need for a city officials' organization, and visualized the services it could render to the cities of the United States. Colonal Compton has been a city official for a long period of years.

In addition to the president, the following officials and members of the board of directors were elected:

President, Capt. H. C. Whitehurst, Washington, D. C.; secretary, Chas. M. Upham, Washington, D. C.; treasurer, James H. MacDonald, New Haven, Conn.; vice-presidents, C. E. Myers, Philadelphia, Pa.; Ben S. Davison, Houston, Texas; W. R. Hopkins, Cleveland, Ohio; John C. Shaw, Los Angeles, Calif.

Directors—Robert B. Brooks, J. P. Broome, W. P. Cottingham, R. M. Gregory, W. J. Jamieson, Chas. Henry Moon, Bryson Vallas, A. D. Butler, C. E. Clarke, Thomas B. Crutcher, Wm. A. Hansell, H. C. McClure, H. E. Nettleton, Ira T. Redfern, A. Mason Harris, O. Laurgaard, Thos. B. Oakley, Harry C. Shaner, Nathan L. Smith, Geo. B. Sowers, James H. Sullivan.

Methods of Resurfacing With Emulsified Asphalt Penetration Macadam in European Countries

Notes on the Practice That Could Be Applied as Well on City Work

By C. L. McKESSON

Materials and Research Engineer, California Division of Highways

MOST of the highways in the European countries have been macadamized for many years. These existing macadam surfaces are frequently utilized without the addition of metal by the simple expedient of surface treatment with emulsified asphalt or tar, but where the road surfaces are more or less irregular or worn the reconstruction practice usually takes the form of penetration macadam resurfacing.

Construction Methods Similar to Ours.—Penetration macadam resurfacing is, in general, constructed in accordance with the approved practices with which we are familiar. Emulsified asphalt has, however, become quite popular in this type of work instead of the ordinary hot asphalt or road oil, and this popularity may be attributed to the ease with which the material can be applied even in unfavorable weather, to the simplicity of the equipment, as well as to the very satisfactory work which has been thus produced. Interesting examples of this work were found in England, France, and Germany. The following descriptions of work as conducted in these countries will show the striking similarity to penetration macadam as we have constructed it in this country, but will also bring out some differences of practice which are made practicable by the difference in form of the bituminous material used.

It should be borne in mind in this connection, that emulsified asphalt is simply a standard asphalt which has been made liquid by the addition of water and a very small amount of emulsifying agent and that, when the emulsion breaks down, the water leaves the road and the asphalt remains in the form of a thin layer over the rock particles. Emulsified asphalt roads at this stage do not differ from roads constructed thinner and there is a marked absence of displacement sometimes noted where excessive amounts of bitumen have been used in hot penetration work. There is also an entire absence of "bleeding" and the texture which results is usually of a type which could be classified as non-skid due, probably, to the thinness of the coating on the rock particles and to the absence of excessive richness in the surface of the road.

Penetration Resurface Over Old Macadam.—Figure 1 is a view of work under way on Leighton-Hockliffe Road, in Bedfordshire, England. This work consists of a penetration resurface over an old tar treated macadam surface. The inspection was made on a damp, misty day and the depressions in the old road surface were filled with water as is shown in the illustration. This, however, did not deter the construction forces. Mr. Mann, the Division Engineer in charge, stated that they had no difficulty in working in this kind of weather and, as there is considerable rainy weather in England, the ability to use emulsified asphalt under this condition is one of its valuable qualities. The engineers accustomed to using it, however, do not recommend carrying on work of this kind during freezing weather.

Figures 2 and 3 are other views of the resurfacing work in the Leighton-Hockliffe Road. Due to the fact that this road is a heavily traveled main highway it was necessary to construct a macadam resurface on one side of the road at a time, allowing traffic to use the other half of the road. In constructing the macadam resurface a very thin layer of sand was first distributed over the old tar macadam. The engineer explained that this was to intercept the emulsified asphalt which penetrates the rock surface and to prevent it from running out to the shoulders. The next stage is to spread a uniform layer of crushed stone which passes a screen having 2 in. circular openings and which is retained on a screen having 1¼ in. circular openings. This material is spread by hand and is rolled lightly with a 10 ton roller to bring out irregularities in the surface. These irregularities are carefully corrected by loosening up and adding more stone where required or by removing stone. After the surface is smooth and uniform a light covering of stone chips was distributed over the surface, as shown in the photo, and swept into the rock. This, the engineer explained, was done to prevent the liquid emulsion from running through the metal too quickly. A comparatively small amount of chips was used at this stage and the voids only partially filled. Excessive rolling at this stage is carefully avoided; the purpose of the rolling being merely to develop irregularities so that they can be corrected.

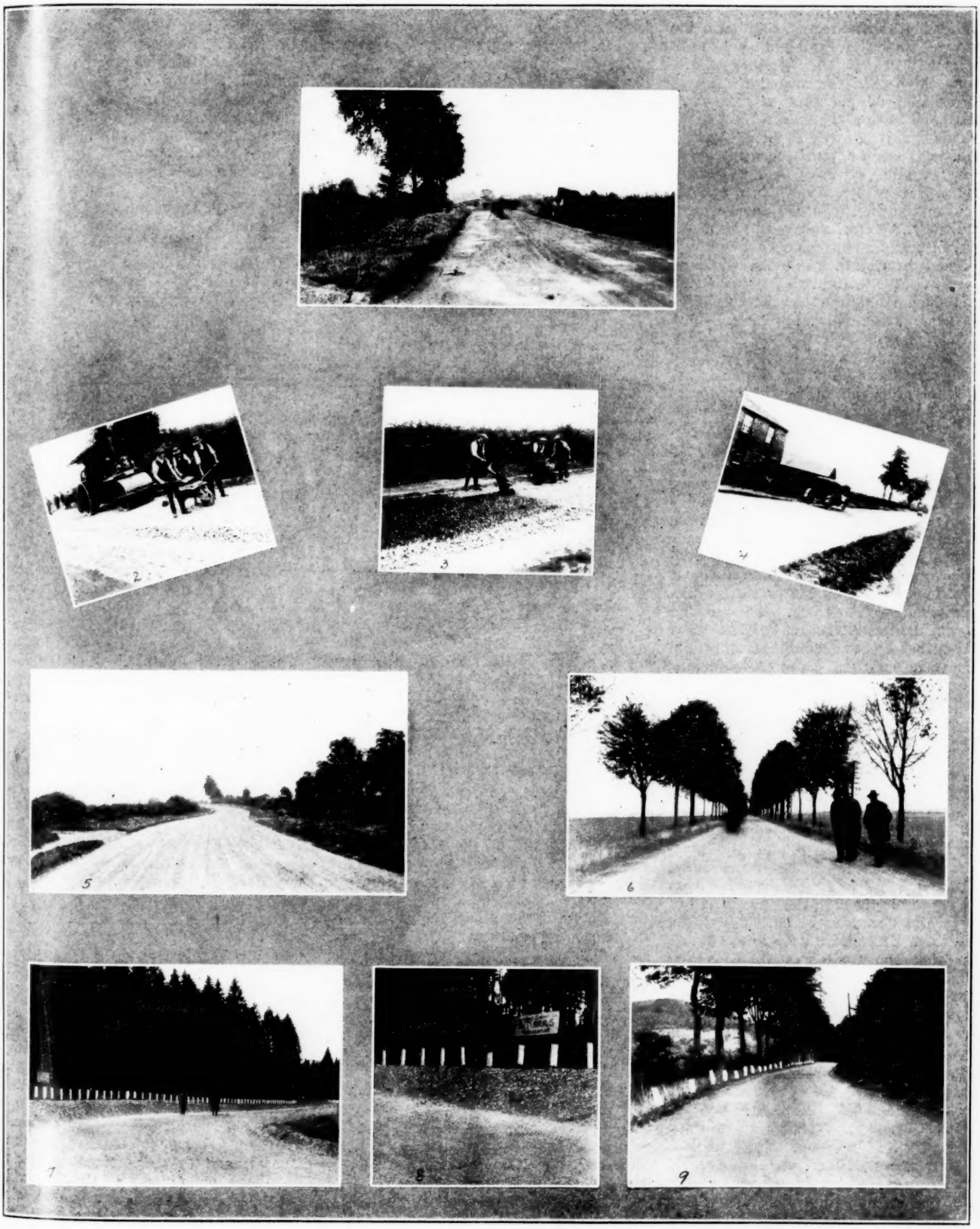
The emulsified asphalt for this work was shipped to the job in metal barrels and applied with hand pouring-pots. The emulsified asphalt pours readily from the barrel and is distributed with remarkable uniformity with the pouring-pots. The first application consisted of 1.64 (U. S.) gal. After this application stone chips were distributed over the surface and swept in until the voids are entirely filled; rolling continuing during this operation. After the surface is thoroughly compacted and filled a seal coat was applied in similar manner using .41 gal. of emulsified asphalt per square yard. This was followed with a cover coat of chips and again rolled.

Figure 4 is a section of this road finished in the same manner several weeks before the inspection. It will be noted that this macadam resurface which is 2½ in. to 3 in. finished thickness used slightly more than 2 gal. per square yard of emulsified asphalt. The emulsion was made from Grade "E" 200 penetration asphalt and contained approximately equal parts of asphalt and water. The actual amount of asphalt used in the road is, therefore, about 1 gal. per square yard. This is about one-half the amount of hot asphalt that would ordinarily be used in this country in a penetration macadam of the same thickness. Inasmuch as the road was well bound and apparently well sealed it is apparent that this result must be made possible by reason of thinner coatings on the particles. The actual amount of bitumen used is apparently about 3 per cent of the weight of the road metal, which is estimated to be about 270 lb. per square yard. This would correspond quite closely with the amount of bitumen which would be used for the same grading in hot plant mixed work.

Figure 5 is a view of another Bedfordshire road with emulsified asphalt penetration surface.

A German Resurface Job.—Figure 6 is a view of the main international road between Neuss and Aachen, Germany. This highway was surfaced many years ago with waterbound macadam over a Telford base. In November, 1926 a 2 in. resurface was constructed in much the same manner as the Bedfordshire resurfacing already described. The first course of stone was from 1¼ in. to 2 in. in size. This was filled with ⅜ in. to ¾ in. screenings, rolled and then given a first application of 0.88 gal. per square yard

of emulsified asphalt. After screening and rolling a second application of 0.44 gal. per square yard of emulsified asphalt was applied. The second application was covered with stone chips from 10 mesh to ¼ in. and a seal coat of 0.22 gal. per square yard of emulsion was applied. This, in turn, was covered with a light coating of the same chips. The



Penetration Macadam Construction in England, France and Germany

(1) Leighton-Hockliffe Road in Bedfordshire, England, (2) Macadam Resurface Construction Over One-half of Road, (5) Applying Emulsified Asphalt, (4) Completed Section of Road, (5) Emulsified Asphalt Penetration Surface on Bedfordshire Road, (6) Main International Road Between Neuss and Aachen, Germany, (7) Penetration Macadam on Nurburg Ring in the Eifel Mountains, Germany, (8) Texture of Pavement on Nurburg Ring. **Fig. 9.—Penetration Macadam on Highway Between Bonn and Trier, Germany**

emulsified asphalt was applied by hand as in the Bedfordshire work. Stone paving-blocks were laid along the edge prior to resurfacing and the resurfacing finished flush with the tops of these header blocks. The resurfacing has a fine texture somewhat resembling Topeka pavement due to the fineness of the stone chips used for covering. It was stated that 60 per cent of this work was done during the rain.

This main highway is in a thriving industrial center and carries a very heavy volume of truck and passenger traffic. There was no evidence of rolling, corrugating, or other displacement and the surfacing appeared to be meeting all traffic requirements.

Penetration Macadam on German Race Course.—Figure 7 shows an emulsified asphalt penetration macadam surface on the Nurburg Ring in the Eifel Mountains, Germany. This is a section of mountain race course 20 miles in length built for use in international auto races. In the construction of this race course the German engineers built sections with each of the types of surfacing most commonly used in Germany for the purpose of studying relative value of the types. The sections included emulsified asphalt penetration, emulsified tar penetration, Tar-Mac, cement concrete, and Essner natural asphalt. The surface, in general, consists of a Telford base about 8 in. in thickness and a macadam surface about 4 in. thick. The section shown in the illustration has a surface consisting of rock from ¾ in. to 1¼ in. in size in sufficient quantity to form a penetration macadam of 2 in. compacted thickness. From 1.3 to 1.5 gal. of emulsified asphalt was applied per squarel yard in three applications with ¼ in. to ⅝ in. stone chips between. On this section the sub-soil is a heavy clay and some difficulty was experienced due to the clay coming up into the macadam. It was necessary to scarify and reroll some of the macadam base before the treatment, and in a few places water was coming from the subgrade through the pavement and surface and running to the sides of the roadway. In spite of this unfavorable condition the road was found to be reasonably smooth and without any breaks or evidence of repairs. There were short sections of grade up to 17 per cent. Figure 8 shows the texture of the pavement.

Penetration Macadam in a Military Road.—Figure 9 is a view taken at Rossburg on the highway Bonn to Trier, Germany. This is a military road built by Napoleon. Early in 1926 a macadam surface was constructed consisting of a basalt with sand for filler 3½ in. to 4 in. in thickness. This, in turn, was covered with 1¼ in. to 2 in. crushed basalt sufficient to form a wearing surface about 2¾ in. in thickness. The wearing surface received a treatment of about 1.25 gal. per square yard of emulsified asphalt, was covered with stone chips and thoroughly rolled. One year later the road received an additional 0.22 gal. of emulsified asphalt per square yard and additional stone chips. The road surface was found to be smooth and uniform with a good non-skid texture. It is on a grade ranging from 5 per cent to 7 per cent. The cost of this bituminous macadam surface was given by the engineer as 75 ct. per square yard. Emulsified asphalt brings $35.00 to $40.00 per ton in this locality. Labor costs are about one-half those in the United States.

Penetration Macadam Over Old Stone-Block Pavement.—On National Route 20 at Chevilly, France a penetration macadam surface has been constructed over an old stone-block pavement. The surface consisted of ¾ in. to 1½ in. rock spread to a thickness of 2 in. and rolled. The stone chips, ⅜ in. to ⅝ in. in size, were distributed over the course of stone and rolled in. 1.4 gal. per square yard of emulsified asphalt was applied in one application and given a light cover of stone chippings. Rolling was continued until the road was thoroughly compacted. Three weeks after, the surface was washed and the roadway received a seal coat of 0.33 gal. per square yard of emulsified asphalt and another cover of stone chips. It was not rolled after this seal coat. The cost of this surfacing was 60 ct. per square yard.

Acknowledgment.—The matter above is taken from a paper presented by Mr. McKesson at a meeting of the Western Association of State Highway Officials.

Exhibitors at Montreal Convention

The following manufacturers and publications have signified their intention of maintaining exhibits at the Montreal Convention of the New England Water Works Association, to be held from September 18 to 21, according to V. E. Arnold, chairman of the Exhibit Committee of the Water Works Manufacturers' Association, Inc., sponsors of the exhibits:

1. Pittsburgh Equitable Meter Company.
2. Thompson Meter Corporation.
3. Neptune Meter Company.
4. Water Works Engineering.
5. The American City.
6. Pittsburgh-Des Moines Steel Company.
7. Engineering News Record.
8. Ross Valve Mfg. Co., Inc.
9. R. D. Wood & Company.
10. Lead Lines Iron Pipe Co.
11. The Pitometer Company.
12. United States Cast Iron Pipe & Foundry Co.
13. The Kennedy Valve Mfg. Co.
14. National Tube Company.
15. Hersey Mfg. Company.
16. Builders Iron Foundry.
17. The Canadian Engineer.
18. Geo. A. Caldwell Company.
19. The Federal Meter Corp.
20. The A. P. Smith Mfg. Co.
21. Paradon Mfg. Company.
22. Union Water Meter Company.
23. W. & L. E. Gurley.
24. National Meter Company.
25. Red Hed Mfg. Co.
26. McWane Cast Iron Pipe Co.
27. Wallace & Tiernan Company, Inc.
28. Public Works (Journal).
29. The Central Foundry Company.
30. Worthington Pump & Mach. Corp.
31. Rensselaer Valve Company.
32. Hydraulic Development Company.
33. Edson Mfg. Company.
34. Badger Meter Mfg. Co.
35. Gillette Publishing Company.
36. Gamon Meter Company.
37. Buffalo Meter Company.
38. Mueller Company.
39. Lock Joint Pipe Company.
40. Eddy Valve Company.

Especially interesting exhibits have been planed by these exhibitors. *Municipal News and Water Works* will, of course, be well represented.

Wilmington, Del., to Build Wharfage

The finance committee of city council of Wilmington, Del., was authorized by council at a recent meeting to arrange for the sale of city bonds to the amount of $350,000 for the purpose of erecting the new 1,400-ft. wharfage addition to the Marine Terminal. Work on the new addition will be started immediately, and until the sale of the bonds is actually made, the expense of the work will be paid from an appropriation of $20,000 which was transferred by special resolution recently from the Special Account Bond Sales to the Special Account Harbor Improvement. The issue of the bonds will probably be made by the finance committee before the end of summer. The addition will be built by the McLean Contracting Company, of Baltimore.

Street Sanitation Officials Meet in Toronto

The International Association of Street Sanitation Officials will hold their 9th annual conference in Toronto, Canada, on October 8 and 9. The headquarters of the conference will be at the King Edward Hotel. A number of interesting authoritative papers on garbage disposal, street cleaning, rubbish disposal, and other pertinent subjects have been announced. Attention will also be given to snow removal, air ports, public parking spaces, comfort stations, department records, advertising matter, complaints, and subjects of interest. A. M. Anderson, 10 So. La Salle St., Chicago, is secretary of the organization.

Rational Design of Asphalt Paving Mixtures For City and Rural Pavements

Research Data Confirming Voidage Basis of Design Given in Paper Presented at Recent Convention

By HUGH W. SKIDMORE and GENE ABSON
Directors, Chicago Paving Laboratory, Chicago, Ill.

DURING more or less continuous investigation of asphalt paving mixtures in the past eight years, we have developed a rational method of designing such compositions. At various times, certain phases of these researches have been reported. All of the information obtained during these years of study seems to constantly and convincingly lead to one outstanding conclusion, viz., that the voids in the dry aggregate normal to sheet asphalt and asphaltic concrete (and all modifications thereof) if correctly determined, establish the quantity of bitumen necessary to satisfy not only practical considerations, but also extended laboratory investigation. Some have reserved acceptance of such a rational design awaiting more convincing proof of a theory. It is believed (after considerable investigation of field mixtures) that even those who, up to this time, have argued that such a premise does not satisfy prior hypothetical considerations, are actually (though unwittingly) following the tenets of the voidage principle.

Design Actually Worked in Field Practice.—Early in our researches into this ever-widening subject, we encountered results both in the laboratory and in the field, which convinced us that such a method of design had some foundation in scientific fact, and possessed the important advantage of actually working out in field practice. Our more recent study has been conceived in a true research attitude of searching for facts that will either prove or disprove our so-far acceptable conclusion, or will bring out indications of another line of reasoning. These latter studies have been directed toward single lines of investigation, rather than "hit or miss" experiments along general lines.

About a year or so ago we undertook a study of aggregates along restricted lines, starting with a sand of one size and systematically building up graded aggregates therefrom. Sand for the major investigation reported here, was obtained from local supplies of sand commonly used in asphalt paving work, known as Lake Michigan sand. It is hard grained, almost pure silica, of more or less waterworn particles, the finer particles being the sharper. A large supply of this material was separated into its various sizes by means of 80, 40 and 10-mesh sieves, and recombined by weight according to specific formula. The sand contains uniformly almost no material passing a 200-mesh sieve and very little retained on 10-mesh. The intermediate sizes sometimes used, have been found to be an elaboration of no practical value, hence were not used beyond the initial sieving of raw sand. In every case of aggregates other than Lake Michigan sand, they are specifically identified.

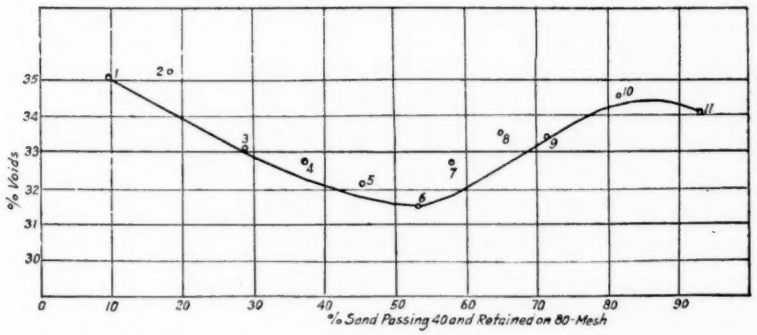


Fig. 1.—Voidage with Respect to Ratio of 40-Mesh to 80-Mesh Sand in 80-40 Combination, Starting with Particles Passing 80 and Retained on 200 and Adding Particles Passing 40 and Retained on 80

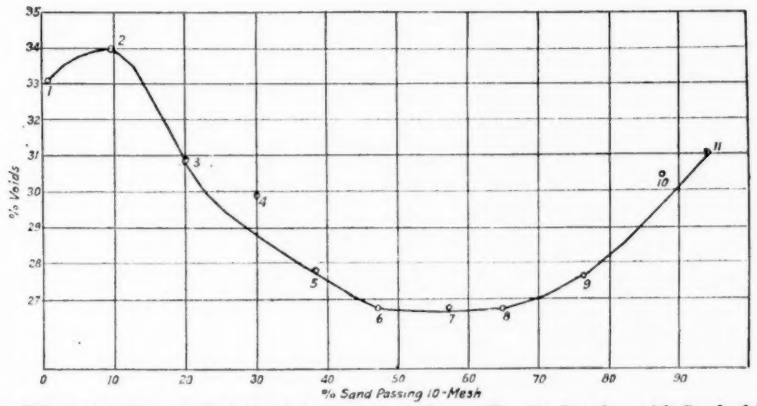


Fig. 2.—Effect of Adding 10-Mesh Sand to Point 3 on Curve (Fig. 1), Starting with Sand of Exact Grading of Point 3 and Adding Sand Passing 10 and Retained on 40

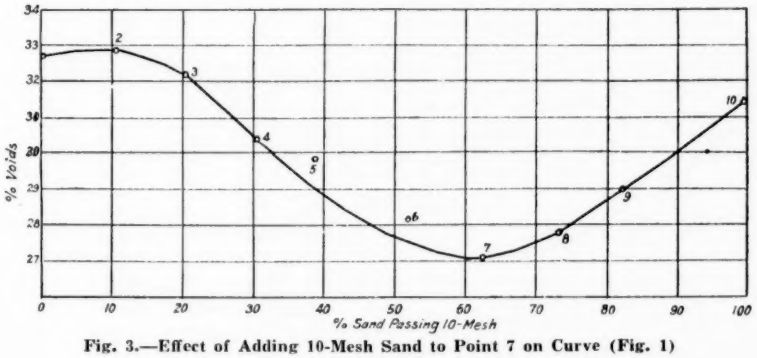


Fig. 3.—Effect of Adding 10-Mesh Sand to Point 7 on Curve (Fig. 1)

From here on, a logical discussion of the work becomes a study of Figs. 1 to 13.

Combinations Common to Natural Sand Grading.—Beginning with a sand passing 80 and retained on 200-mesh, particles passing 40 and retained on 80-mesh were added in 10 per cent increments. The curve (Fig. 1) shows a gradual decrease in voids to about 50 per cent, 40 and 50 per cent 80-mesh,

then a gradual increase as the 80 sand approaches zero per cent. This offers a variety of ratios of 40 to 80-mesh for further study by the addition of sand passing 10-mesh and retained on 40-mesh. Three such combinations were chosen:

	Points on Curve 80-40 S		
	Point 3	Point 7	Point 9
Passing 200-mesh	2.0%	1.9%	1.0%
80-mesh	69.4%	39.8%	27.2%
40-mesh	28.6%	58.3%	71.8%

This gives us three distinct combinations quite common to natural sand grading, viz., high 80, low 40; 40 somewhat above the 80; and high 40, low 80.

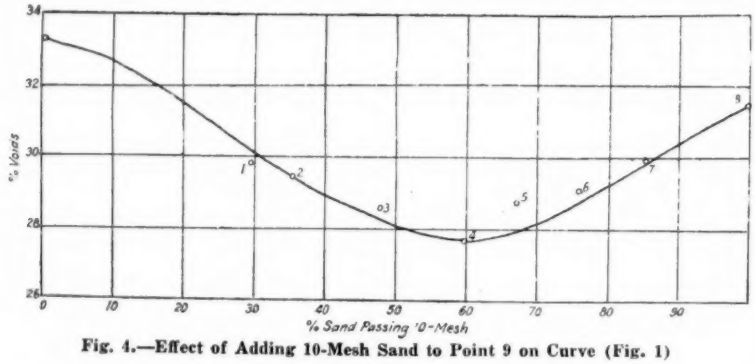


Fig. 4.—Effect of Adding 10-Mesh Sand to Point 9 on Curve (Fig. 1)

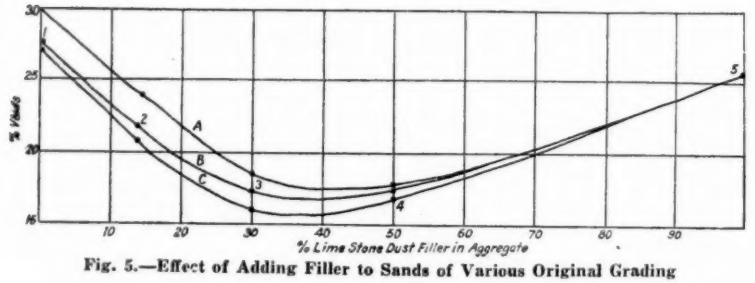


Fig. 5.—Effect of Adding Filler to Sands of Various Original Grading

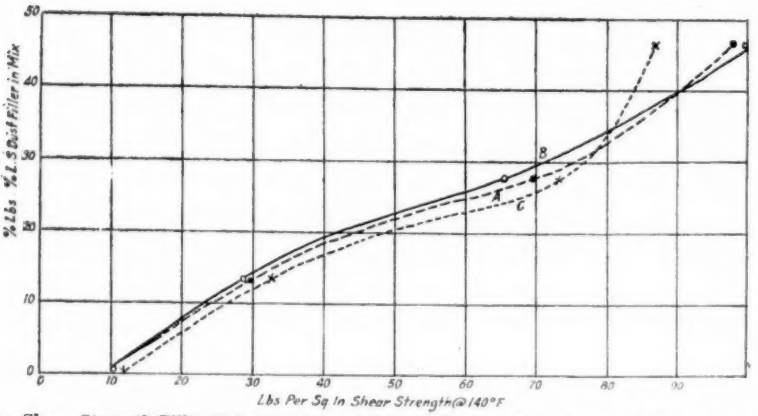


Fig. 6.—Shear Strength-Filler Relationship. Mixtures Designed from Curves (Fig. 5) with A. C. (40 Pen. Mex.) Just Filling Voids in Aggregate

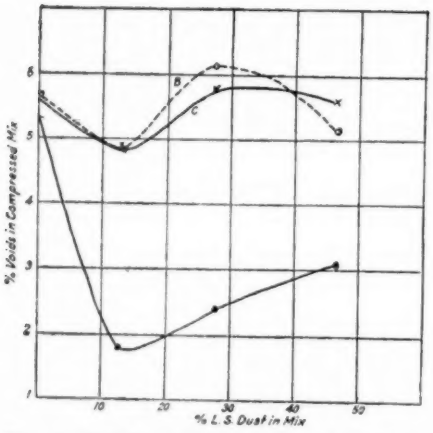


Fig. 7.—Relative Compressibility of Mixtures Designed from Curves (Fig. 5) with Bitumen Filling Voids in Aggregate

Effect of Adding 10-Mesh Sand.—By adding 10-mesh particles to a high 80, low 40 sand we note (Fig. 2) the lowest voids occur between 40 and 70 per cent of the coarsest material. This gives us quite a wide range of low voidage sand with respect to the exact amount of 10-mesh, but it does show very conclusively, what we have always known from experience, that a fair amount of coarse sand between 10 and 40-mesh is essential to low initial voids.

In Fig. 3 we note the effect of coarse particles upon a moderate 80-40 combination, and again we see that the lowest voids are accomplished with a fairly high percentage of 10-mesh. Note especially that the lowest voids on the curve (Fig. 3) are almost identical (27 per cent) with those on Fig. 2.

In Fig. 4 we see the effect of 10-mesh sand upon a low 80, high 40 ratio, which is not at all uncommon in natural sand grading, and is frequently almost impossible to correct by any combination of available materials. You will again note that 60 per cent of 10-mesh gives the lowest voids, and also that voids do not go quite as low with this ratio of 80-40 as with either of the others.

Effect of Filler on Sands.—We now approach a more complex problem, that of studying the effect of filler upon sands of various normal grading. It would be impossible to show this study complete, so we select gradings that characterize some of our more common field conditions. Three such original sands are selected for study in combination with limestone dust filler of excellent quality, the same being a ground limestone from Quincy, Ill., one representing what we have always felt gave best results in actual practice; one high 80 and 10, with low 40; and one with low 80, medium 40 and high 10, which is common to coarser sand sometimes found necessary to use. A fourth combination of high 80 and 40, with very low 10-mesh, could have been added, but it is productive of such high voids as to be considered wholly undesirable. These three sands show original gradings as follows:

	Point No. 1 Curve 80-40 S 9	Point No. 5 Curve 80-40 S 3	Point No. 7 Curve 80-40 S 7
Passing 80-mesh	25%	40%	15%
40-mesh	45%	20%	25%
10-mesh	30%	40%	60%

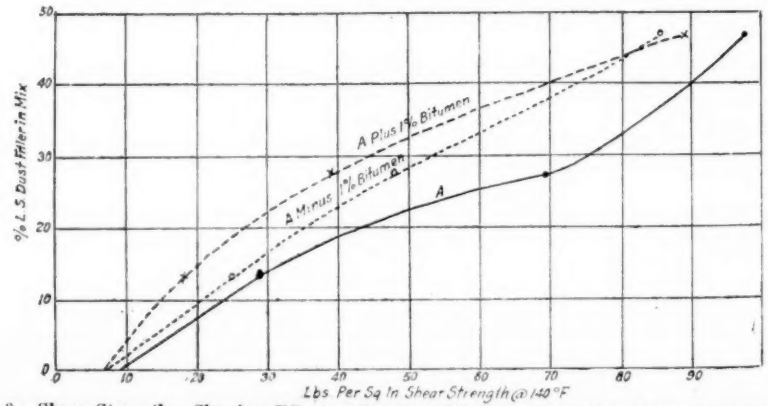


Fig. 8.—Shear Strength. Showing Effect of Varying Bitumen 1 Per Cent More and Less Than Amount Required to Fill Voids in Dry Aggregate

In Fig. 5 we see the relative responsiveness of these three sands to reduction of voids by the addition of filler, and we note that the coarsest sand is productive of lowest voids as is characteristic of such sands, although not enough lower to be of any great consequence so far as final mixture is concerned unless it is also as workable and compressible and develops unusual stability. We are then confronted with two very important considerations; the relative stability, and compressibility of these three sands when in final composition.

In studying the behavior of mixtures employing these three sands, we first design them according to the voidage principle, and, since the amount of final voids is controlled by the filler-content, we plot stability (shear strength at 140 deg. F.) against per cent of filler in the mixture; each separate mixture containing the amount of bitumen required to fill voids in the dry aggregate; the same bitumen (40 penetration Mexican) being used in all.

While the coarsest sand gives the highest strength, you will note (Fig. 6) that the difference between the three sands is not phenomenal since they are about 10 lb. per square inch apart as a maximum for any given filler-content. Now we come to the next very important question, viz., how do they compare as to compressibility?

Relative Compressibility.—Here we find a pronounced difference, and our "A" sand gives by far the best results (Fig. 7). Knowing no more about the problem, we would be strongly inclined to some similar grading in practice. In fact we have consistently been so inclined right along although we had not previously analyzed the matter so exhaustively.

Having determined the approximate grading of, let us say, a model sand, we now come to the important question of variation in bitumen content, above and below the amount required to fill the voids, both with respect to stability and compressibility. For the sake of a rounded-out investigation, this feature was studied for the two more extreme gradings as well as the "model" sand.

Effect of Varying Bitumen.—In the case of the model sand, we find (Fig. 8) it produces highest strength with bitumen commensurate with voids, and the "dry" mix coming next to it, with the "fat" mix the weakest.

As to compressibility, the dry mix, as might be expected, shows up rather badly in comparison with normal bitumen and likewise the richer mixture (Fig. 9). It is to be expected that a mixture containing bitumen in excess of that actually required to fill voids will be rather easily compressed at high temperatures as such a mixture borders upon (and with enough bitumen becomes) a mastic. But it is clearly evident that such excess of cementing medium materially reduces the stability of the mix. For the model grading, we find that normal bitumen (that amount necessary to fill voids) is just as compressible as the rich mix up to a filler content that would usually be the maximum in regular practice.

Now dealing with a weaker and less compressible original mixture, we find (Fig. 10) that normal bitumen gives lower stability than the lean mix, up to about 25 per cent of filler; but taking it all the way through, shows a little better average value than the slightly leaner mix and is considerably superior to the rich one.

NB: It must be borne in mind that 1 per cent more or less bitumen is really a small amount, and differences shown will naturally be greater for greater variations as has been previously shown by investigations of a somewhat different nature reported by Gene Abson last year.

Now we come to the matter of relative compressibility (Fig. 11) of this mixture which in the first instance was much less compressible than that employing a sand of superior grading; and we find that the normal mixture is considerably less susceptible to compression than the one containing 1 per cent excess of bitumen, and the lean mix with 1 per cent less bitumen is in turn less compressible than the normal one.

Coming now to the third series of mixtures employing a coarse sand which showed the highest stability of the three original mixtures, and compressibility about equal to the "B" mix but much less than the model sand or "A" mixture, we find (Fig. 12) the plus and minus 1 per cent bitumen curves in approximately the same relation to the normal as was true of the "B" series, with an earlier reduction in strength for the lean mixture.

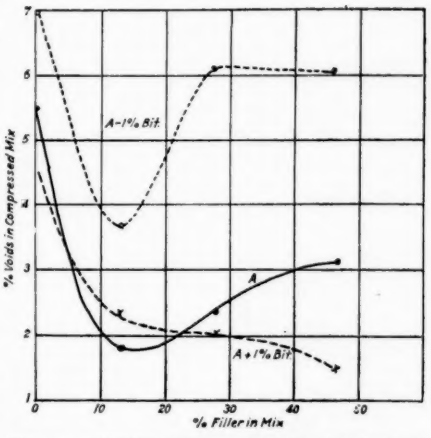


Fig. 9.—Relative Compressibility. Mixture A (Fig. 6) with 1 Per Cent More or Less Than Required Amount of Bitumen

Also we find (Fig. 13) the relative compressibility of the three mixtures about the same as for the "B" series, and it will be recalled that the original "B" and "C" mixtures were quite similar in this respect.

Mixtures from Ideally Graded Materials Most Stable.—From the foregoing, it is clear that certain ratios of sizes in any mineral aggregate are desirable from the standpoint of stability and workability of final mixture. As we have previously pointed out, lowest voids in the sand are not necessarily productive of the best results in the mixture. There is an optimum condi-

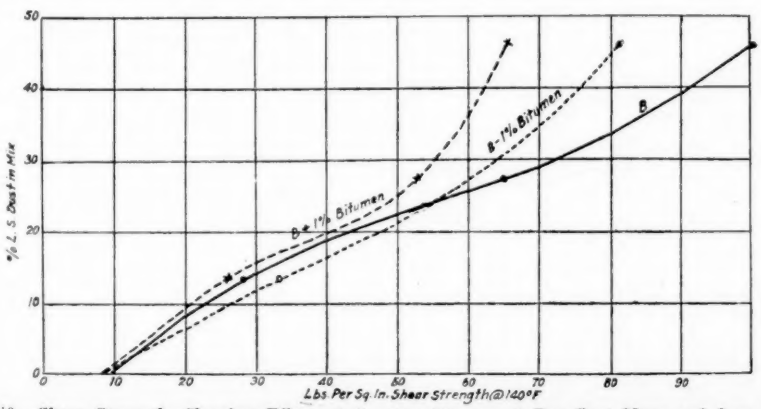


Fig. 10.—Shear Strength, Showing Effect of Varying Bitumen 1 Per Cent More and Less Than Amount Required to Fill Voids in Dry Aggregate

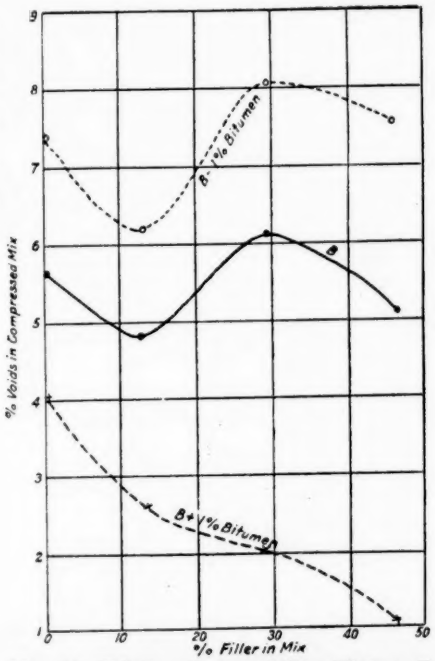


Fig. 11.—Relative Compressibility Mixture B (Fig. 6) with 1 Per Cent More and Less Than Required Amount of Bitumen

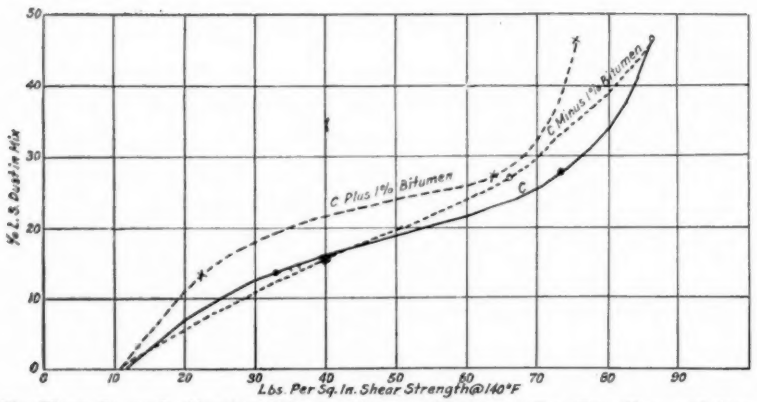


Fig. 12.—Shear Strength, Showing Effect of Varying Bitumen 1 Per Cent More and Less Than Amount Required to Fill Voids in Dry Aggregate, Curve C (Fig. 6)

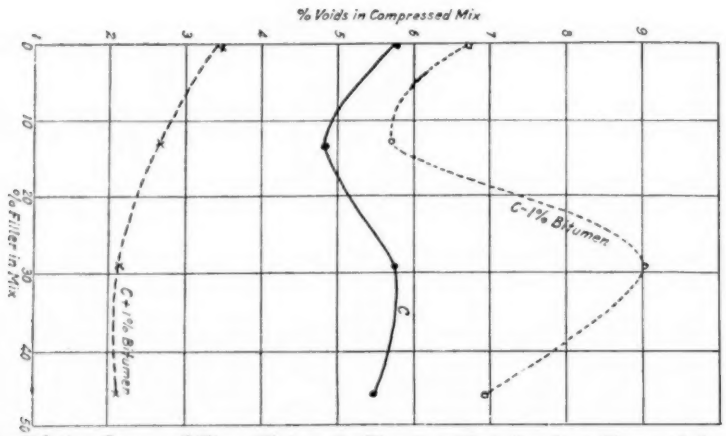


Fig. 13.—Relative Compressibility. Mixture C (Fig. 6) with 1 Per Cent More and Less Than Required Amount of Bitumen

tion, with respect to low voids and final practical considerations. These facts are, of course, not new, but it seems that a rather clear-cut and decisive proof is offered by these studies. Conclusive proof of the undesirability of using very coarse or very fine sands is clearly in evidence here.

The results just discussed appear to us as offering very substantial evidence of the correctness and practicability of the voidage basis of design of mixtures as well as the great usefulness of shear strength (simple shear) as a means of laboratory investigation of mixtures and materials and practical control. It seems perfectly obvious that this rational method of design is based upon data that clearly points out weaknesses in mineral structures of inferior grading, and shows conclusively that when paving mixtures employ what may be termed ideally graded materials, these mixtures are not only most stable but also most workable and most susceptible to compression, when the amount of bitumen present fills or just about fills the voids in the mineral. Previous researches reported by us have also pointed in the same direction, and further work is constantly developing new data that strengthen previous conclusions.

All mixtures were made under standardized laboratory procedure employing heated steel molds, with 2 in. cylinders molded at 350 deg. F. under a load of 5,000 lb. per square inch vertical pressure applied on a hydraulic press, and pressure released immediately. Shear tests were all made at 140 deg. F. in water-bath, shearing load being applied at the rate of 2 lb. per square inch per second. The consistency of results, smoothness of curves, etc., indicate that the entire procedure as to determining voids and testing mixtures is thoroughly developed.

Resident Engineers' Camps

From the Construction Manual of the State Highway Department of Minnesota

The location of an engineer's camp should be as near the middle of the project as practical. This will keep the auto mileage at a minimum. In most cases it is well to be on the detour of the project. Camp should be located near available telephone service. Install one in camp, if possible.

When locating a camp on private property a written agreement shall be entered into with the property owner covering the amount of rental and the removal of temporary buildings, constructed for the camp, at the termination of the agreement.

Vacant buildings are sometimes available, otherwise, 14 ft. by 16 ft. tents are satisfactory. Three such tents with 5 ft. side walls make sufficient housing for a seven-man party. One tent can be used for an office and sleeping quarters for the resident engineer and instrument man. Another will house from four to seven men. The third tent will be the kitchen and cook's quarters. These tents should be framed, floored and walled up, about 18 in. around the bottom.

In some cases a sand point can be sunk where wells are not available.

An ice box, 2 by 2 by 4 ft., with tight cover, can be sunk in the ground, handy to the kitchen. This should be in the shade. A 200 lb. piece of ice will last four or five days.

At the beginning of the job, a requisition of canned goods and other staple groceries sufficient for two months should be sent to the central office. Minor articles and fresh meats should be purchased locally, bills being submitted monthly.

A boarding house statement should be prepared at the end of each month. This statement shall show the exact cost of each meal served and should be prepared similar to the following report:

BOARDING HOUSE STATEMENT.

ENGRS. CAMP S. P.....

Covering Period.....to.....19.....

Inventory of supplies on hand last report....$
Groceries received during this period.....
Vegetables received during this period.....
Fresh meats received during this period.....
Ham and bacon received during this period
Butter received during this period.....
Eggs received during this period.....
Miscellaneous received during this period....
Fuel received during this period.....
Ice received during this period.....
Freight, express and parcel post.....

TOTAL .....$
Cook's salary .....$

Total .....$
Inventory of supplies on hand this date.....$
Total cost of meals.....$
Number of meals served crew.....
Cook's meals .....
Complimentary meals (visitors, etc.).....

Total number of meals served.....
Average cost per meal.....

Depreciation on equipment.....
Total cost per meal.....$
Signed.....

Res. Engineer.

A camp is the home of a party for several months and should at all times be neat, clean and sanitary. Old clothes, boxes and debris should be burned. Beds should be made up when arising and blankets aired and sunned at intervals.

A sanitary outhouse and covered garbage hole should be constructed back of camp. Lime should be used in both at frequent intervals. This is required by law.

When camp is abandoned, the whole camp site should be cleaned up. The outhouse and everything left behind should be burned and disposed of.

Road Signs Advertise City

Findlay Chamber of Commerce, Findlay, Ohio, has installed a series of signs on highways leading into the city. The signs advertise the city's advantages as an industrial center.

Water Purification and Softening Plant at Piqua, O.

Description and Operating Results Given at Ohio Water Purification Conference

By J. M. MONTGOMERY
Superintendent of Water Works, Piqua, O.

PIQUA is located in Miami County on Miami River. Its population in 1920 was 15,044. Previous to June, 1924, the public water supply was obtained from the hydraulic canal which was supplied with water by three small lakes and the Miami and Erie Canal. In June, 1924, a flood occurred which washed out the banks of the hydraulic canal and cut off the water supply of the city. An emergency pumping station was then installed, the pumps taking suction directly from Miami River; the water was chlorinated and pumped to the consumers. Previous to the installation of the filtration plant, the water was not of satisfactory quality and was not generally used in the city for domestic purposes. The existing water purification and softening plant was constructed during 1925 and 1926 following an order from the State Department of Health to provide a satisfactory water supply for the city. It was put into operation in March, 1926.

Source of Supply.—The water supply is ordinarily obtained from Swift Run Lake, one of the series of lakes along the hydraulic canal; water flows by gravity from the lake to the filtration plant. Provision is made for drawing water from Miami River by a low lift pumping station equipped with two 3 mgd. pumps. The low lift pumps discharge either to Swift Run Lake or to the filtration plant. The water entering the plant is measured by a venturi meter and the amount is controlled by a hydraulic valve operated by a float in the settling basin.

Aerators.—The water is aerated through a system of 48 Sacramento nozzles spaced 9 ft. center to center on the roof of the settling basins and carbonation chambers. The water from the aerators passes to the mixing tanks. Piping arrangement permits the aerators to be by-passed.

Chemical Feed Devices.—Alum is fed into the water by means of two "Gauntt" dry feed machines. Each feeder is equipped with a dissolver and the dissolved alum is piped to the point where the raw water enters the mixing tanks.

The lime is stored in two steel bins. Immediately under these bins are two 2,000-lb. weigh hoppers hung on Toledo scales. The weigh hoppers discharge into the lime feeders. The lime is first weighed and then fed into a slaker by means of a "Browning" feeder. This feeder was developed by Oren Browning, the chief operator of the Piqua plant. It consists of a horizontal cylinder and a piston with adjustable stroke. Lime drops into the cylinder through an opening in the top and the piston discharges it into the slaker through an opening in the bottom.

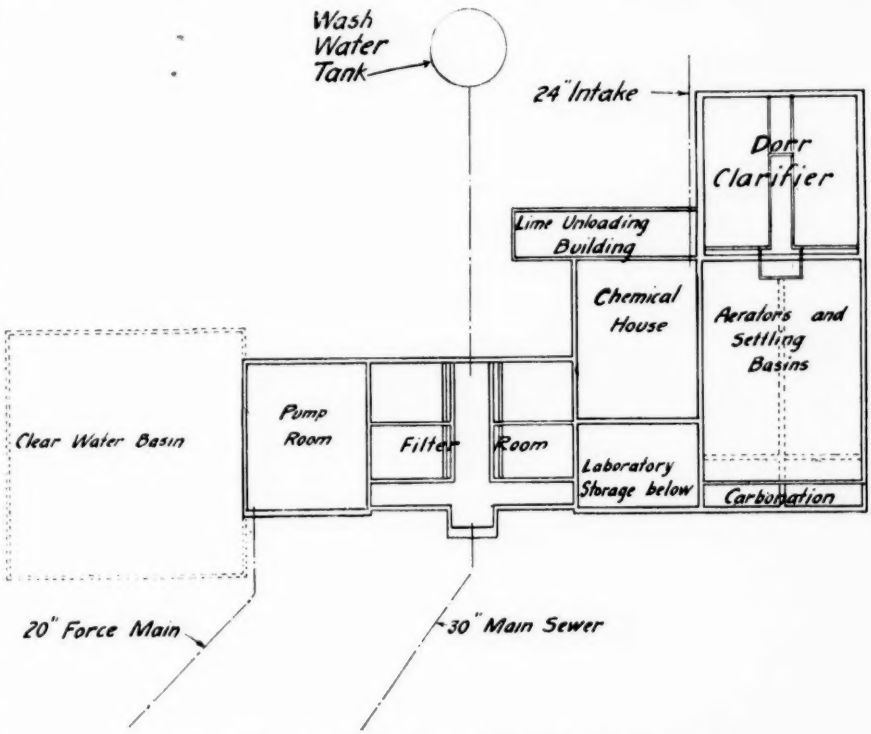


Fig. 1—General Plan of Piqua Water Purification and Softening Plant

From the slaker, the lime solution is piped to the point where the raw water enters the mixing tanks. The feeder is an integral part of the slaker.

The Browning feeder gives a very regular and uniform application of lime. Once set it requires very little attention except for an occasional cleaning. The scales provide an additional check by showing the operator how much lime has been fed in any given length of time.

Mixing Tanks.—There are two steel, circular, mechanical mixing tanks designed for operation singly, in parallel, or in series. The tanks are 21 ft. in diameter with an effective water depth of 22 ft., a total capacity of 114,000 gal. and a detention period of 33 minutes at the rated capacity of the plant—5 mgd.

Mixing is effected by a propeller at the bottom which rotates around a central shaft. Additional mixing is effected by a vertical baffle on the side of the tank. The propellers are rotated so as to produce a velocity of 1.1 ft. per second.

Dorr Clarifier.—From the mixing tanks the water passes through a concrete channel to the Dorr clarifier. The clarifier is 50 ft. square with an effective depth of 14.9 ft. providing a capacity of 280,000 gal., a detention period of one hour and 20 minutes and a velocity of 0.53 ft. per minute at the rated capacity of the plant. The water enters the basin through twenty 10-in. holes in the bottom of the inlet trough. Directly under these holes there is a wooden baffle bracketed out from the wall which effectively kills the entrance velocity. The water leaves the clarifier over a weir which extends entirely across the basin. Sludge removal devices are standard Dorr equipment, the sludge being pumped by a Dorrco pump.

Settling Basins.—There are two settling basins arranged for operation in parallel only. Each basin is 24.88x61.83 ft. in plan with an effective depth of

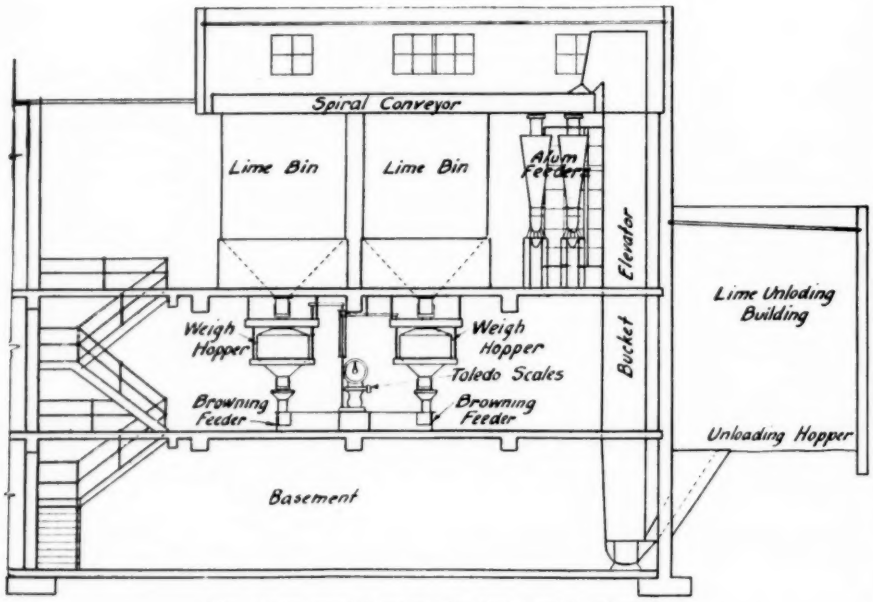


Fig. 2—Sectional View of Chemical Feed Equipment

18.5 ft. The total capacity of the two basins is 425,000 gal., which provides a detention period of two hours and a velocity of 0.5 ft. per minute at the rated capacity of the plant. The water enters each basin through twelve 6-in. square openings in the bottom of the inlet channel and the outlet to the carbonating chamber is through 6-in. square openings 3 ft. below the flow line in the wall separating the settling basin from the carbonation chamber. Each basin drains to a central channel which slopes to the inlet end where the sludge is withdrawn through a sluice gate.

Carbonation Chambers.—The carbonating chambers are located adjacent to the settling basins. Each basin is 24.88x14.75 ft. in plan with an effective depth of 18 ft. The total capacity of the two basins is 99,000 gal., which provides a detention period of 28 minutes at the rated capacity of the plant. The water flows under a vertical baffle and flows out through an outlet chamber controlled by 2x8-ft. stop plates. The carbon dioxide distributing system consists of a grid of ¾-in. pipes on the bottom of the tank, which pipes are perforated on the bottom with $\frac{3}{16}$-in. holes spaced 12 in. center to center. The carbon dioxide generating equipment consists of a combined coke burner and scrubber, and a compressor driven by a variable speed motor.

Filters.—There are four filters, each with a rated capacity of 1.25 mgd. Each unit is 18x24 ft. in plan with a total length of 8 ft. Each filter is provided with three cast iron wash water troughs of adequate capacity for a 24-in. rate of wash. The filtering material consists of 26 in. of sand supported on a 2-in. layer of torpedo sand and 5 layers of gravel.

The filter underdrains consist of 3-in. laterals spaced on 12-in. centers connected through 4-in. risers to a 2-ft. square concrete manifold beneath the filter. Filter equipment consists of Simplex controllers, rate of flow and loss of head gages. All valves are hydraulic valves controlled from operating tables.

Wash Water Facilities.—A wash water tank having a capacity of 30,000 gal. is located west of the filters. This capacity provides for one 5-minute wash of one filter at a rate of 24-in. vertical rise. The wash water tank is filled from the high service mains through an automatic valve.

Clear Well.—Located south of the pump room is the clear well, 75 ft. square with an effective depth of 12 ft. Its capacity is 500,000 gal., which provides a storage period of 2.4 hours at the rated capacity of the plant. The clear well is covered with a concrete roof, on which there is an 18-in. earth fill.

Disinfection.—Chlorine is applied to the filtered water in the main effluent line leading from the filters to the clear well. A pedestal type W. & T. chlorinator is located at the west end of the filter operating floor.

Operating Results.—All of the equipment at the Piqua plant is working out very satisfactorily. The percentage removal of sludge by the Dorr clarifier has been made a routine test. To date the average has been 97 per cent, with a minimum of 94.5 per cent and a maximum of 99.6 per cent. Very little is left for the settling basins to take out. They have been washed out but twice since the plant was put into operation 18 months ago. In the operation of the clarifier approximately 0.75 per cent of the total water taken into the plant is wasted in removing the sludge.

The filters are being run at a rate of 150 million gallons per acre per day. At this high rate the filters are averaging 28 hours between washings. The amount of wash water required is 1.7 per cent of the total quantity of water taken into the plant.

Table I shows an average of the chemical results for September, 1927. The results for the treated water appear to be low because these samples are heated to 50° C. before analysis in order to complete the chemical reaction and to give a true indication of the chemical treatment.

The exceptionally low alkalinities obtained in the filtered water are due to a new method of treatment which has been worked out and put into effect. The rest of this paper will be devoted to an explanation of this treatment.

Carbonate hardness cannot be reduced to zero by treatment with lime because the calcium carbonate formed by the addition of lime is soluble to the extent of about 17 parts per million. This figure is the ultimate limit toward which the lime softening plant can work.

In actual practice in the past, the limit to which carbonate hardness could be removed was much higher than 17 parts per million. The limited results that could be obtained were due to the presence of magnesium in the raw

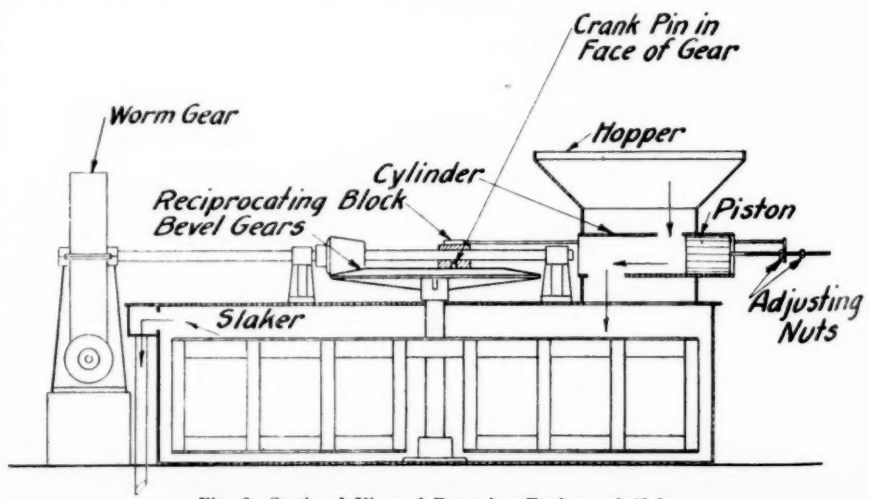


Fig. 3—Sectional View of Browning Feeder and Slaker

water and to the formation during the softening reaction of complex magnesium compounds which were soluble in water. These compounds, according to Hoover, have the following formula:

$Mg_4 (OH)_2 (CO_2)_3$
$MgCO_3 NaHCO_3 4H_2O$
$MgCO_3 NaCO_3$

These basic carbonates are most likely to be formed when soda ash is used along with lime in the treatment of the water, but they are also formed when lime alone is used if the raw water contains magnesium carbonate.

A great deal of work has been done, and a number of papers have been written on how to lower the limit to which carbonate hardness can be removed by lime treatment. It is possible to add an excess of lime and in this way precipitate practically all of the magnesium. The excess lime is then neutralized with soda ash, leaving free sodium hydroxide in the water. This treatment is both expensive due to the use of soda ash and objectionable due to the free sodium hydroxide. Split treatment, which consists of mixing all of the chemicals required with a part of the water and subsequent mixing with the rest of the water, is helpful but does not greatly lower the point to which the carbonate hardness can be reduced. Compounds of aluminum are also helpful under certain conditions, but they, too, are expensive.

Another method has been made possible by the installation of carbonation equipment in connection with lime-soda water softening plants, namely—overtreatment with lime followed by recarbonation. This treatment has been used at Piqua since the middle of June of this year.

At the time that the carbonation plant at Piqua was first put into operation, considerable difficulty was being experienced in regulating the lime feed. At times the water would be overtreated and at other times undertreated. During this time, beginning in August, 1926, a great number of freak results were obtained which were difficult to account for. At times the alkalinity of the filtered water would be as low as 18 parts per million.

A study of the daily analytical sheets showed that these low alkalinities always followed a period of high overtreatment with lime followed by recarbonation to the point where the total alkalinity minus two times the phenolphthalein alkalinity equalled approximately 5. The following is a typical example.

Total Alkalinity (M. O.) 23
Phenol Alkalinity (Ph.) 9
23—(2x9)=5

At that time it was impossible to get these results consistently because of the difficulties with the lime feed.

J. R. Baylis early in 1927 obtained similar results in his laboratory. He overtreated water until he had a caustic alkalinity of 110 parts per million and then recarbonated. The resulting water showed a carbonate alkalinity of only 30 parts per million.

Mr. Hoover in one of his papers has also mentioned overtreatment with lime followed by carbonation as a method of reducing carbonate hardness.

Early in the summer of 1927 Browning dry feed machines for lime were put into operation at Piqua. These machines gave a very accurate feed and it was then possible to try to duplicate consistently the freak results obtained before. In Fig. 5 will be found Curve I, showing the alkalinity of the filtered water during a typical month under the old treatment. Curve II shows the alkalinity of the filtered water during the month of September, 1927, as a result of the new treatment.

It was found that for the Piqua water it was necessary to add lime in excess and to the extent of obtaining 40 parts

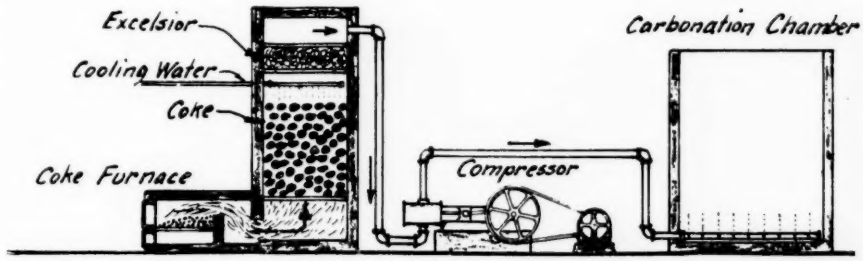


Fig. 4—Sectional View of Carbonation Plant

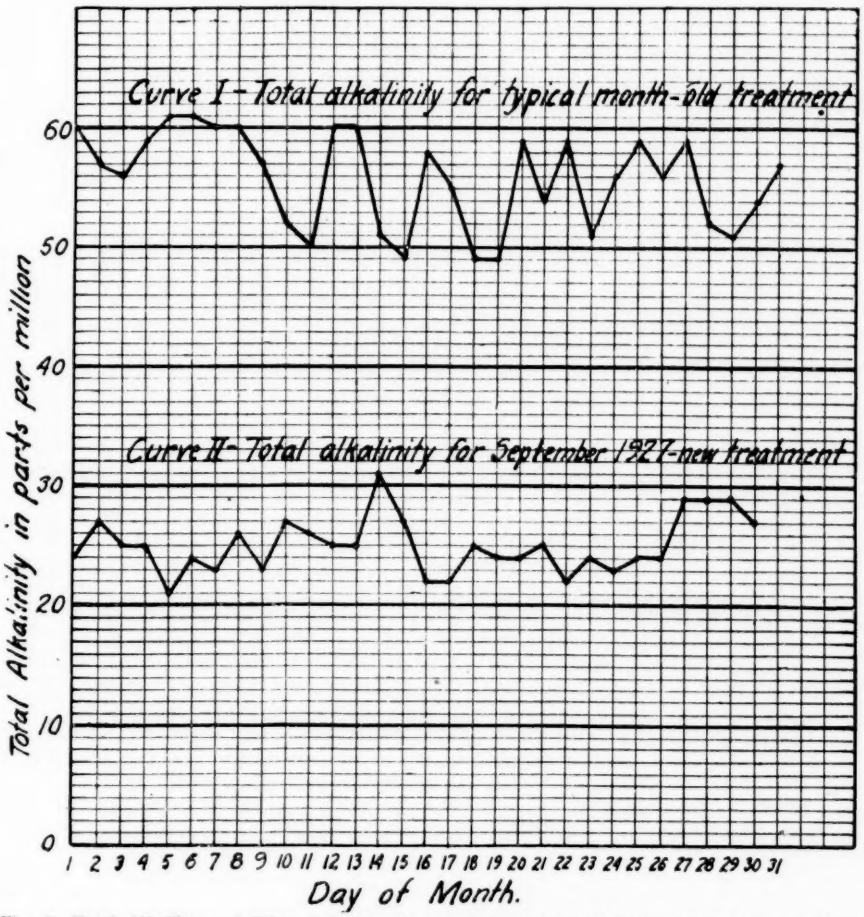

Curve I - Total alkalinity for typical month-old treatment
Curve II - Total alkalinity for September 1927-new treatment
Total Alkalinity in parts per million
0
10
20
30
40
50
60
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31
Day of Month.

Fig. 5—Total Alkalinity of Filtered Water Compared for Typical Months Under Old and New Methods of Treatment During 1927 at Piqua

Table I—Average Results of Chemical Analyses During September, 1927, for Water Before and After Treatment at Piqua Water Softening Plant

	Raw Water	Treated Water	Settled Water	Carbonated Water	Filtered Water
Total Alkalinity	228	73	88	50	24
Basicity	.....	32	26	43	20
Causticity	.....	41	58	....	....
Incrustants	32	32	31	31	32
Total Hardness	260	105	119	81	56
Magnesium	25	.....	.....	....	5

Sample heated to 50° C. before analysis.

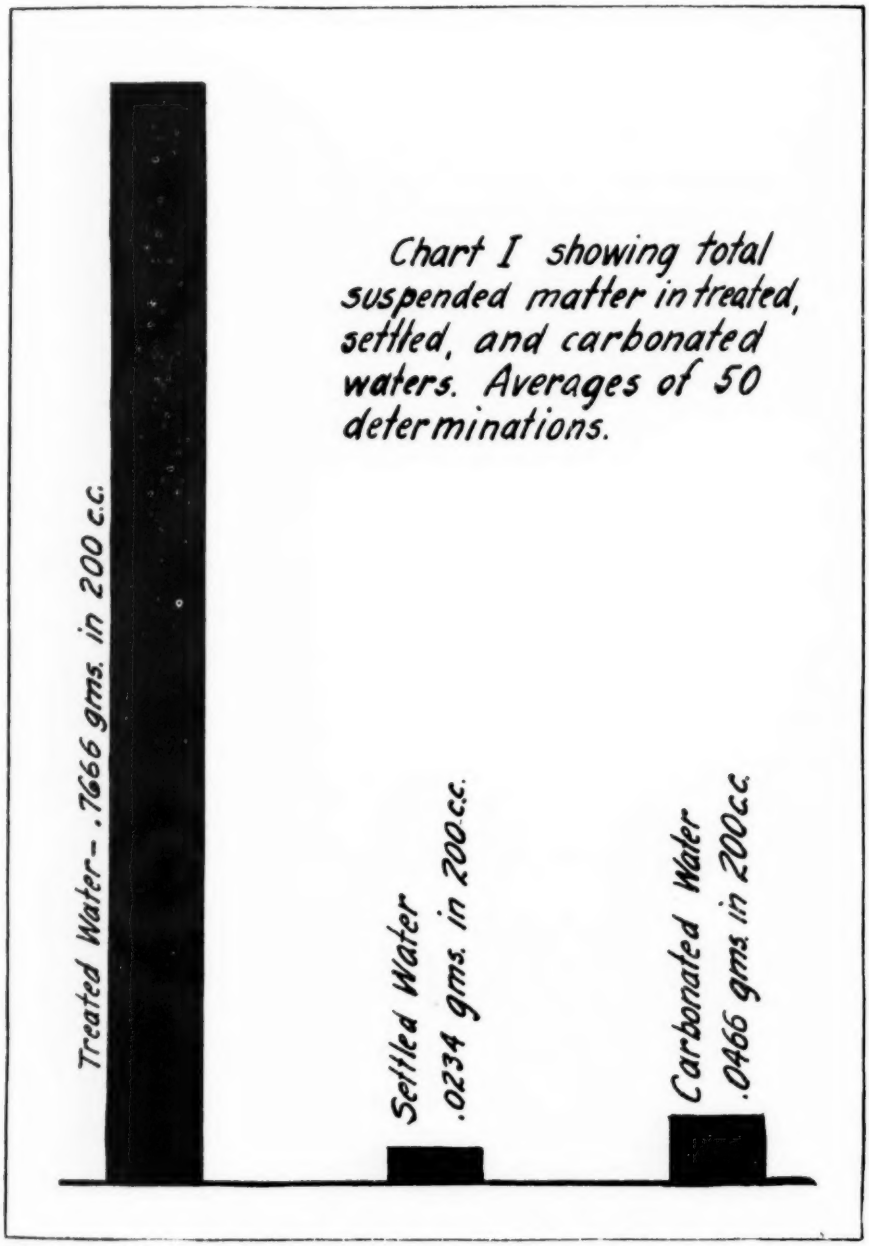


Chart I showing total suspended matter in treated, settled, and carbonated waters. Averages of 50 determinations.
Treated Water - .7666 gms. in 200 c.c.
Settled Water .0234 gms. in 200 c.c.
Carbonated Water .0466 gms. in 200 c.c.

Fig. 6—Total Suspended Matter Compared for Softened Water Before and After Carbonation Using New Method of Treatment at Piqua

per million causticity. Any less than this amount gives correspondingly higher alkalinities in the filtered water. Any more than this amount is unnecessary. The water is then recarbonated to the point where the total alkalinity minus two times the phenolphthalein alkalinity equals approximately 5. After passing the filters the water then has a total alkalinity of 20 to 25 parts per million, consisting of 15 to 20 parts per million of normal carbonates and 5 parts per million of bicarbonates.

Very strict regulation of both the lime and carbon dioxide feed is required to produce these results. The treated water at Piqua must have at least 40 parts per million of caustic alkalinity and any slight deviation from the required amount of carbon dioxide will make a great difference in the finished product. The total alkalinity minus two times the phenolphthalein alkalinity must be very close to 5.

The chemistry of this treatment is assumed to be as follows. Due to the heavy overtreatment with lime practically all of the magnesium is precipitated in the form of flocculent magnesium hydrate. When the magnesium has been precipitated, the chief obstacle in water softening has been removed. The alkalinity due to calcium carbonate is very readily reduced. In the carbonation process the excess lime or free calcium hydroxide is precipitated as calcium carbonate, which is removed by the filters. Quantitative determinations made every day for a period of 50 days show that there is twice as much suspended matter in the carbonated water as there is in the settled water. Chart No. 1 in Fig. 6 is made from the averages of 50 daily determinations and shows graphically the quantities of suspended matter in the treated, settled and filtered waters.

Water treated by this process will, possibly, cause incrustation of the sand in the filters, but the filtered water is so close to the theoretical solubility of calcium carbonate that it gives no indication of causing any deposit whatsoever.

Fig. 7 was prepared by Mr. Baylis and shows the relation between hydrogenion concentration, total alkalinity and the incrusting properties of waters. The curve shows that if a water has an alkalinity of 24 it can have a pH of 9.6 and will not cause incrustation. The water at Piqua has an average alkalinity of 24 and a pH of 9.1, therefore it should not form any deposition whatsoever after it has passed the filters.

The extra softening provided by this method of treatment costs but slightly more than the ordinary lime softening process. It has been customary in lime softening plants to carry about 5 parts per million of caustic alkalinity in the treated water. The new treatment requires 35 parts per million in addition to this amount. Thirty-five parts per million of caustic alkalinity is equivalent to 20 parts per million of 100 per cent CaO. This in turn is equivalent to 140 lb. of 100 per cent lime to remove approximately 30 parts per million of hardness from the million gallons of water. If 100 per cent lime costs $10 per ton, this is a cost of 2.5 ct. per part per million, per million gallons of water treated. The cost of ordinary lime treatment at Piqua with 100 per cent lime at $10 per ton is 4.0 ct. per part per million, per million gallons. The cost of soda ash treatment, with soda ash at $30 per ton, is 12.0 ct. per part per million, per million gallons.

If this process does cause incrustation of the filter sand, the cost of replacing the sand must be added to the extra cost for lime. The filter sand might be considered as a softening agent. The filters at Piqua contain 130 cu. yd. of sand. At $5 per yard it would cost $650 to completely replace the sand. If the sand had to be replaced in 10 years the cost would be $65 per year to remove approximately 30 parts per million of hardness. At the present rate of consumption this is equivalent to a cost of 0.36 ct. per part per million, per million gallons of water treated. The cost of lime (2.5 ct. per part per million) plus the cost of sand (0.36 ct. per part per million) makes 2.86 ct. per part per million, per million gallons. The additional 30 ppm. of hardness which is removed by this method is removed more cheaply proportionally than the other 170 ppm. of hardness.

The amount of carbon dioxide used is about the same as is used for regular

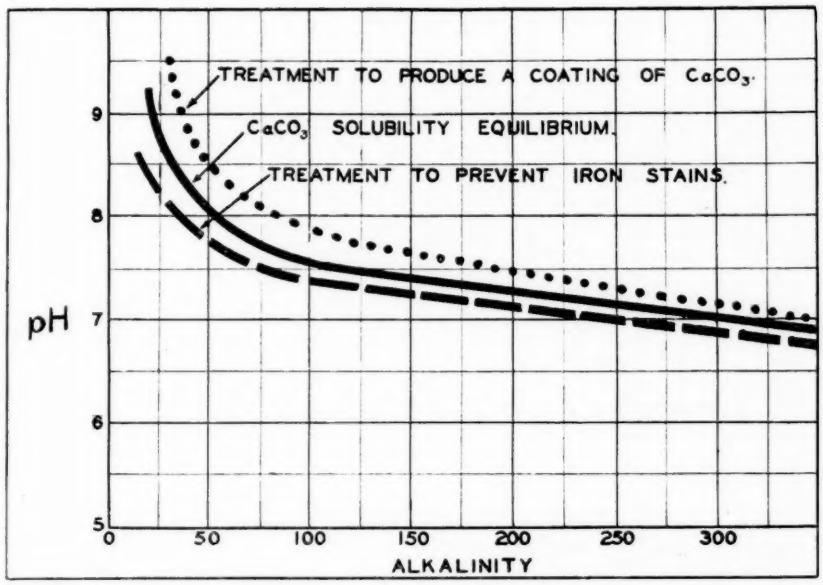


Fig. 7—Relation of pH and Alkalinity to the Proper Treatment of Water to Prevent Corrosion

lime treatment. The new treatment uses only enough carbon dioxide to convert the caustic alkalinity to normal carbonate alkalinity and crystaline calcium carbonate. The regular treatment uses the carbon dioxide to convert the caustic and normal carbonate alkalinities to bicarbonate alkalinity. The quantity of carbon dioxide required for each method of treatment is about the same.

The total hardness of the filtered water is averaging about 50 to 55 parts per million without the use of soda ash. Without the new method of treatment the total hardness would be 80 to 85 parts per million. The additional softening is greatly appreciated by the consumer.

Sewage Disposal Improvement at Columbus, O.

The city of Columbus is ready to start on its large program of sewage disposal improvement, according to "Ohio Health News" of July 15. General plans of the Olentangy-Scioto intercepting sewer were approved in June. The construction of this new interceptor is the first step in improvement of the sewage collection system for the city, to be followed by improvements in pumping facilities and sewage treatment. The city is under order of the State Department of Health to install the necessary improvements to correct the pollution of the Scioto river and Alum creek.

The new interceptor is liberally designed in the effort to reduce pollution due to overflows to the river from the combined sewer system to a definite minimum. It is estimated that only four overflows a year will occur in the downtown section, and eight in the upper section of the new sewer, and those of course, will be at times of severe rains and high stages of the river. The flow in an intercepting sewer of the size planned will naturally frequently exceed the capacity of the proposed enlarged sewage treatment plant. This is to be cared for by the construction of so-called storm standby tanks which will accomplish two things. (1) storage of light storm flows, with subsequent discharge to plant, and (2) sedimentation of heavier and more prolonged storm flows. This feature is an innovation in Ohio and so far as known in the United States, although more or less common in some of the European countries, particularly England.

The new work is being carried on by the office of the city engineer. The personnel of that department has been enlarged; Orris Bonney is in charge of new sewerage, and Robert Allton in charge of sewage disposal design. John W. Gregory, Baltimore, as consulting engineer, has general supervision of the improvements.

Condition of Filter Sand After 17 Years' Use

The filtration plant of Bangor, Me., has been in operation for over 17 years. During 1927 the sand was removed and the laterals and strainers cleaned in all of the units. The following note regarding the sand is extracted from the report for 1927 of James M. Caird, Chemist and Bacteriologist of the plant: "When the sand was placed in the filters 17 years ago it had an effective size of .44 mm and a uniformity coefficient of 1.50. During the washing of the filters some of the finer sand was lost, so that at the end of 13 years the sand had an effective size of .72 mm and a uniformity coefficient of 1.66. During the past year some fine sand has been added to the filters to take the place of that lost during washings."

Canadian Cities' Architecture Control

Canadian cities and rural provinces are applying the principle that there are amenities in architecture, and that violation of them are an offense which the community has the legal right to prohibit.

Complete control over the architecture as well as over the location and height of buildings, public and private, to be erected in the city of Quebec is given to the new Quebec Town Planning Commission created by a far-reaching provincial bill which has just been passed.

The commission is given not only the right to pass on proposed structures from the standpoint of neighborhood architectural harmony, but is also given full power to replan those parts of the city that have suffered from what has been characterized as "building anarchy."

The city of Ottawa has also applied for and received right to exercise architectural control over certain proposed new developments. The province of Alberta in a new town planning act has authorized a permanent provincial town planning board, one duty of which shall be to "assist and advise any rural authority in devising ways and means of preserving the natural beauty of the locality and insuring that new buildings and erections therein shall be so designed and located as not to mar the amenities of the locality." It takes definite cognizance of buildings located on any highway to which the act applies, making regulations as to their design and construction.

California cities are given the power to control the architecture of private structures planned to be erected within their boundaries under the wording of the state's planning act of 1927, and in some instances they are already exercising such powers, the National Association of Real Estate Boards points out.

Great Britain has a town planning act which gives power to a local authority to prescribe the character of buildings. A number of cities, notably Edinburgh and Bath, have interpreted the clause to mean community control over the design of buildings as well as over suitability of their location.

Fort Worth, Tex., to Advertise

Inauguration of a Department of Publicity at Fort Worth, Tex., with expectation of eventually entering the list of community advertisers, has been announced by the Fort Worth Association of Commerce. The new department is in charge of Ed. F. Flannery, former Florida newspaperman. For the present the department will devote much time to plans for a future advertising fund for the city.

Recent Studies at Houston Activated Sludge Plant

Notes on the Disposal of Sludge

By G. L. FUGATE AND W. S. STANLEY
Assistant City Engineer, Chemist, Houston, Tex.

UP to 1920 the only means of excess sludge disposal at Houston, Texas, was lagooning.

It has been repeatedly observed that when pH of sludge in lagoons falls below 7.0 a thick crust of undigested solids forms on the surface of the lagoons, accompanied by a highly offensive odor. This can be remedied in mild cases by hosing the lagoon with fire hose. Aggravated cases were known to persist for 10 days or more, and were alleviated only by persistent stirring and hosing. The addition of lime would doubtless help, but the cost of such procedure makes its use out of the question.

Lagooning Not Practicable.—From the above it is apparent that lagooning is not practicable in Houston, especially if we consider the highly putrescent effluent of 900 p.p.m. B.O.D., which has to be either discharged directly into Buffalo Bayou or retreated in the plant. The last recourse would put an undue load on the activated sludge plant, whereas the first would contribute excessively to the pollution of this navigable stream.

It therefore became necessary to turn toward a method free of those objectionable features. Such a method was thought to be filtration, yielding stable effluent and salable solid material.

Consequently a dewatering plant was built and put in operation in January, 1921. This plant consisted of three cypress sludge settling tanks of 50,000-gal. capacity each, two plate and frame presses and one direct indirect heat Buckeye dryer.

The performance of the dryer was quite satisfactory, but the filter presses proved very expensive to operate. After a year of use they were discarded and a standard wet machine used in paper pulp industry installed. This machine was quite an improvement over the plate and frame presses, but due to high cost of blanket roll was replaced by a modified "Decker" type machine. The conditioning agent used for plate and frame presses was mostly sulphuric acid and with "Decker" sulphur dioxide gas.

The pulp machines showed an excessive loss of suspended solids through the screen which condition, coupled with high cost of replacements to wire screen and felt blankets caused abandonment of their use. At the end of July a 4-1 vacuum disc filter was installed and intensive experiments started, which terminated successfully in February, 1926. The filtering installation at the North Side Disposal Plant will consist of sludge conditioning equipment and the filter proper.

Filtering Requirement for the Activated Sludge.—Activated sludge to be successfully filtered must conform to certain requirements:

1. As the sludge will not filter well in its raw state, it must be conditioned by means of some chemical. The conditioner must be added in the right amount to insure proper pH.

2. The sludge must be well aerated. An improperly aerated sludge will not filter well no matter what its conditioning.

3. It must not be septic. The fresher the sludge the less conditioner it requires and the better it filters.

4. There must be as little agitation as possible after addition of conditioner.

To insure freshness, sludge will be brought directly from settling tanks and filtered immediately, without storage.

To insure proper conditioning a sludge feeder of the bucket wheel type and a conditioner solution feeder of the same type will be installed, both operated by the same countershaft, and so arranged that the proportion of conditioner to sludge when once adjusted will not vary, no matter how the speed of filtration varies, unless adjusted again by the attendant.

The pH of conditioned sludge will be checked by both the colorimetric method and by measuring the resistance of sludge as it flows to the filter. In the latter method there will be employed a recording millimeter, which will give continuous and permanent record of the condition of sludge as it enters the filter.

In order to allow the sludge to mix intimately with the conditioner without being violently agitated a long baffle box with alternating over and under baffles will be employed. This will insure a large well formed floc, just such floc as is necessary for best filtration.

The Conditioner.—The selection of the conditioner seems to be one of the most important factors of the whole process of sludge dewatering. Sulphur dioxide gas and sulphuric acid gave indifferent results as far as Houston practice is concerned, while aluminum sulphate and chlorinated copperas are efficient and the choice between the two is only a uqestion of price.

Consequently it was decided to install suitable equipment for chlorinating copperas, as well as storage facilities for handling aluminum sulphate.

The pH at which sludge filters best was fixed as follows:

1. For sulphur dioxide pH between 3.2-3.6.

2. For sulphuric acid pH 3.4.

3. For aluminum sulphate, between pH 4.4 and 4.8 with good results.

4. For chlorinated copperas, pH 5.4 seems to be the point at which consistent good results were obtained.

It was found that a high pH "mudding" of the cloth occurred. This is caused by the wet sludge smearing over the surface of the cloth and stopping filtration. On the other hand low pH causes "white spotting." This is a peculiar condition of cloth where conditioner used acts as a mordant and fixes certain colloidal substances in the pores of the cloth, thus checking the rate of filtration. Both conditions are quite detrimental to the successful operation of the filter and should be guarded against.

The speed of the filter depends upon the condition of sludge. The best results were obtained in Houston at a speed of one revolution per 12 minutes.

The kind of cloth to use for filtering medium has not yet been determined. We have used palma twill and burlap cloth with equal success as far as the rate of filtration is concerned. The wearing quality of palma twill is the only argument in its favor. Woolen blanket cloth will also be considered.

The drying of cake obtained by filtration did not present serious difficulties when the moisture was kept below 85 per cent. There was, therefore, no reason for immediate research in this direction. All energy was centered upon the filtration problem. This being successfully solved, the next step will be the study of drying conditions. With this in mind, a recording pyrometer and a recording hygrometer are going to be installed to study and record both the temperature in the dryer and the humidity in exhaust gases.

Acknowledgment.—The foregoing is a paper presented at the 10th Texas Water Works Short School.

Tree Planting for Parks and Streets

Some Notes on Practice in England

By W. DALLIMORE
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THE selection, planting and care of trees in public parks and open spaces, and in streets and roads, present some of the most difficult problems that confront arboriculturists. Under the best possible conditions, problems in culture and administration are liable to arise that are unsuspected when cultural activities are confined to private grounds, and even the enthusiasm of tree-loving residents may become embarassing to municipal officials if their enthusiasm is not leavened with knowledge and caution.

Young Trees.—The production of trees suitable for planting in streets and roads is a costly undertaking. Nurserymen have them on their hands five to ten years, throughout which time they must be transplanted regularly, pruned and carefully cultivated. Few nurserymen are in a position to take large risks, but if a definite demand were made, and nurserymen were assured that certain trees in large numbers would be required by a given year they would be only too happy to produce them.

Whenever possible it is wise to raise trees from seeds. This can be done with many species, but species that do not seed freely, hybrids and varieties, must be raised by other means—cuttings, layers, grafting or budding. Grafted trees are usually less reliable for exposed positions than those raised from seeds, cuttings or layers. At the end of the first year they are planted in nursery lines, care being taken to reject weaklings and diseased and deformed plants. From this time onwards attention is directed towards the production of a uniform root system with a good provision of fibrous, feeding roots, and the development of a stout single trunk with short side branches bearing ample, healthy leaves.

Trees may be left in nurseries until they are 16 or 18 ft. high, but it is not always wise to allow them to remain so long, and sturdy trees 10 to 14 ft. high are usually more satisfactory than larger ones. In fact, for park planting, trees 6 to 8 ft. high are large enough, and the earlier in life they can be transferred to permanent places the better it is for the trees.

General Park Planting.—Trees may be required to form avenues, groups or isolated specimens. Except for groups, general trenching of the ground is out of the question, but large holes should be excavated for the trees. Generally, the poorer or harder the soil the larger should be the holes, but for permanent trees no hole should be less than 4 ft. in diameter in the best ground, and in poor soil be dug 2 ft. deep and the bottom be well broken up. Should permanent water be found at that depth ground drainage is necessary. Very poor soil should be removed and replaced by better material, and soil from near the surface of the ground must be kept for placing about the roots of the trees.

As soon as dug the holes may be filled to within 9 or 12 in. of the surface, taking care to tread the soil firm. The holes should then be allowed to settle for a few weeks before planting. At planting time any injured roots must be cut clean and the roots spread out to their fullest extent, taking care to work fine soil in amongst them and to well firm the soil.

The depth of planting is very important. It is necessary that the upper roots should be kept near the surface of the soil, and a rod placed across the top of the hole, resting on the natural soil level at each side, gives a guide to planting depth. Deeply planted trees rarely give such good results as those where the upper roots are kept near the surface of the ground. A good watering after planting helps to settle the soil about the roots. Trees with moderately heavy heads may require staking until such times as they are well established, but stakes should not be used when the trees appear to be standing firm. Watering in dry weather may be necessary during the first year or two after planting, and a mulch of decayed manure and leaves placed above the roots will help in establishing the trees.

When selecting positions for trees consideration should be given to their size at maturity and space allowed for their proper development. Spacing which appears absurdly wide at planting time may give trees so little room as to result in crowding 25 years later, a time when it may be impossible to give more space. Should a temporary furnished effect be desired, permanent trees should be given proper space and be interplanted with nurse trees which can be removed later on. Avenues are often made too narrow, and the trees planted too close together in the rows through not taking into account the average size of the trees at maturity.

The judicious use of trees of varying habit, such as round-headed, pyramidal, weeping-branched trees, and so on, should be considered in the layout of a park, for one helps the other in the general effect; also the selection of vantage points for those of particular merit, either as isolated specimens or groups, should receive careful attention, and the provision of a dark background and special shelter for those that flower very early in the year in advance of leafage is an advantage.

Widely spaced trees are liable to develop laterally at the expense of height, and this tendency must be corrected by pruning. Shortening and the removal of branches must be carried out with care, clean cuts must be made parallel with the bark of the main branch or trunk, leaving no vestige of a snag, and the wounds must be dressed with coal tar or some other antiseptic dressing as soon as made.

Small open spaces are often more difficult to deal with than parks. Some are better adapted for flower gardening than for trees, but there are others where trees and shrubs are undoubtedly the proper things to plant. In spaces to which the public are admitted shade trees are usually popular.

By all means avoid the more gardeny kinds of shrubs, such as those with variegated leaves, for these positions, and encourage a free system of growth; too often a variety of shrubs are planted in small open spaces and subjected to one or more hard annual clippings, whereas a mass of one suitable freely grown plant would be infinitely more pleasing.

Trees in Streets.—A generation ago municipal authorities employed fewer men trained in tree cultivation than is usual at the present time, but even now there are places where the management of street trees is under the control of people who have had no definite training in question concerning trees and their cultivation. This may be the reason why, upon examining unhealthy trees, it is sometimes found that not only have unsuitable kinds been planted in poor soil, in holes scarcely wide enough for the spread of the roots, and that from 8 to 15 in. of the trunk have been buried.

There are reasons why trees which attain a considerable height should be employed in roads and streets, but it is difficult to understand why such heavily branched and heavy leafed trees as horse chestnut, plane, lime and common elm should have achieved such great popularity, while the infinitely lighter and more graceful silver birch and false acacia have received comparatively little attention. Even in moderately narrow roads widely spaced birch trees

could be allowed to develop to their full size with little pruning other than the removal of lower branches.

Where no definite provision has been made for trees in the original layout of the road they must be placed in the footpaths.

The distance they can be planted from the curb with safety is an important question, probably 18 in. may be regarded as the minimum. Trees planted closer than that are likely to have their trunks injured by wide vehicles or overhanging loads, which may be crowded into the side of the road, and may themselves be sources of danger to traffic. Even at a minimum of 18 in. the trunks will probably be too near the curb at the end of 20 or 25 years' growth. It must also be considered how such trees are likely to interfere with pedestrians, and whether sufficient space for aeration and water can be left uncovered by pavement. Small growing trees would really be better for narrow roads were it not for the difficulty experienced in keeping the branches out of the way of traffic. Trees of narrow, pyramidal, or fastigiate habit are better suited to such positions than trees with spreading branches, but are rather difficult to increase quickly.

Difficulties sometimes arise through the roots of trees lifting the paving stones on the footpaths, and engineers are very anxious to know of trees that do not cause such trouble. I am afraid that they are hard to find. Roots, as they increase in size, must find additional space. There are obstructions all round them, road foundations, cement roads, pipe lines, house foundations, walls and what not. Above them are paving stones; the line of least resistance is taken, and the paving stones are lifted by the growing roots.

Where streets are wider and there is additional footpath space an open area of ground is sometimes left between the curb and pavement for the accommodation of trees. This is in every way an excellent idea, and one to be encouraged. It would even be an advantage in many instances if road engineers would, where space is limited, arrange for a narrow footpath on one side of the street and a wide one on the other, restricting tree planting to the wider side, and perhaps concentrating the various service lines along the other.

Causes of Damage to Street Trees.—Service lines laid near trees have on several occasions been the cause of injury to street trees, more particularly leaking gas mains, and fungus diseases have commenced through injury to roots during repair work. Moreover, trees are made unstable by cutting the roots. The full extent to which trees suffer through these service mains is not understood.

How far modern road construction and surface dressings may affect the health of trees it is difficult to say, but the restriction of the roots by deep cement roads may lead to slow development, and cause the soil to dry rapidly in periods of drought. Tar dressings may adversely affect street trees, although if serious consequences were very likely to result the ill-effects should now be apparent. On the other hand, tar dressings have beneficial results by decreasing dust.

How far leaves and fruit falling on smooth-surfaced roads in wet weather may increase the danger of skidding is problematic; the question might be worthy of consideration. Also whether the pounded-up leaves or fruits of certain kinds of trees would be more dangerous than those of others.

In some instances more attention should be paid to the removal of branches from trees. They are often removed in a careless manner, and in addition to ugly stumps being left, the possibility of the wounds healing is remote. Roadside trees from which branches have been removed on account of traffic, or because they were dangerous, are often left in a very unsightly condition. The filling and cleaning of wounds in trees is another operation that should receive attention. By proper treatment many years may be added to the life of certain kinds of trees.

Acknowledgment.—The above is an abstract of a paper presented June 21 at the annual meeting of the Institute of Municipal and County Engineers of Great Britain.

Essentials of a Good Municipal Report

By C. E. RIDLEY
National Institute of Public Administration

I. Date of Publication.

1. Promptness. The report will have little value unless published soon after the end of the period covered—six weeks as a maximum.

II. Physical Makeup.

2. Size. Convenient for reading and filing, preferably 6 in. by 9 in.

3. Paper and type. Paper should be of a grade and the type of such size and character as to permit easy reading.

4. Important facts. The more important facts should be emphasized by the use of different types of artistic presentation.

5. Attractiveness. The cover, title, introduction, and general appearance should aim to attract the reader and encourage further examination.

III. Content.

A. Illustrative Material.

6. Diagrams and charts. Certain established rules should be followed to insure an accurate and effective presentation.

7. Maps and pictures. A few well chosen maps to indicate certain improvements, and a liberal supply of pictures, if pertinent to the report should be included.

8. Distribution. Great care should be exercised in placing the illustrative material contiguous to the relevant reading material.

B. Composition

9. Table of contents. A short table of contents in the front of the report is a great aid for ready reference.

10. Organization chart. An organization chart or table indicating services rendered by each unit, if placed in front of report, will help the reader to a clearer understanding of what follows.

11. Letter of transmittal. A short letter of transmittal, followed by summary of outstanding accomplishments and recommendations for the future, should come early in the report.

12. Recommendations and accomplishments. A comparison of past recommendations with the progress toward their execution will serve as an index to the year's accomplishment.

13. Length. Fifty pages should be the maximum length.

14. Literary style. The text should be clear and concise, reflecting proper attention to grammar, sentence structure, and diction.

15. Arrangement. The report of the various governmental units should correlate with the organization structure, or follow some other logical arrangement.

16. Balanced context. The material should show a complete picture and each activity should occupy space in proportion to its relative importance.

17. Statistics. Certain statistics must be included, but wherever appropriate, they should be supplemented by simple diagrams or charts.

18. Comparative data. The present year's accomplishment should be compared with those of previous years, but only with full consideration of all factors involved.

19. Financial statements. Three or four financial statements should be included showing amount expended and the means of financing each function and organization unit.

20. Propaganda. It is unethical and poor taste to include material for departmental or personal aggrandizement. Photographs of officials, especially of administrators, do not belong in a public report.

Acknowledgment.—The foregoing is reprinted from the March "National Municipal Review."

City Insures Its Water Mains.—The city of Wilmington, Del., has insured the water mains, which were exposed by the work of the contractors constructing the new bridge over the Brandywine River at 18th St., for $300,000. At the meeting of the Street and Sewer Commission a warrant was ordered drawn for $2,500 as the premium of the policy. The insurance is made payable to the mayor and city council of the City of Wilmington.

How to Beautify Grounds Surrounding a Water Works

Simple Landscaping Principles Outlined at Convention S. W. W. A.

By JAS. D. FOWLER

ONE thing which has been greatly neglected around water works plants is the beautification of the surrounding grounds. It is a thought worthy of consideration by public officials, or any tax-paying citizen.

Why Water Works Grounds Should Be Beautiful.—Water works grounds should be beautified for psychological reasons if for no other. Beautiful things or surroundings suggest purity.

A water works is only one of the several utilities which should be given the beautification treatment such as will be outlined in this paper. Electric light plants, gas plants, ice plants and sewage disposal plants should be given equally as much attention.

The general opinion is, especially in the smaller towns, that to spend money for beautification is a waste of money, that the water will not be made any better thereby and that the revenue of the plant will not be increased. We may have to admit that there is no direct benefit derived but there surely is an indirect benefit. A well cared for and beautified water works plant is sure to be seen by someone and possibly many who in turn will tell others and the result will be advertisement for the town.

It may be that the city officials will say there are no funds for such a purpose, but the real difficulty is with such officials that they have not been able to visualize and see the beauty in nature. It is wonderful and marvelous the progress which has been made in the manufacture and development of machinery but such is as of naught compared with the things of nature. When we see the seed planted in mother earth and it bursts forth into a beautiful flower or shrub then that is something to marvel about. When a little landscaping is done we are getting back closer to nature and the things that are beautiful.

Too often we find that a water works plant, especially those owned by a municipality, it is the business of everybody, hence nobody's business. The writer has observed generally, that privately owned plants are given more attention along beautification lines than are municipal plants.

Chief Operator Not to Blame.—The chief operator of a plant cannot always be blamed for lack of attention along beautification lines and is oftimes not recognized in his effort to accomplish something. When he applies for financial assistance the city council or authorities do not appreciate the value and necessity of such expenditure and he is turned down in his request. This disgusts the operator, he resigns and then is probably replaced by an incompetent man who will not worry them and who can be employed at a modest salary.

One who expects to accomplish something must realize that the road is not always smooth. He must have that sticktoitiveness and educate the public and more particularly the city authorities with whom he has to deal. He can do this by keeping his plant clean and on a small scale begin to beautify the grounds. He can get some of the citizens to visit the plant and appreciate what is being done and from then on enthusiasm and interest will grow and out of town friends will be invited to visit the plant.

Beautification a Separate Problem for Each Plant.—The landscape development is a distinct problem for each individual plant. The ideal way to proceed would be to employ a landscape architect to prepare plans and make suggestions for the improvement. This, of course, would require an outlay of cash and this, as has been pointed out, is very difficult to secure.

Also, as has been said, the work can be begun in a small way. It is not necessary that the entire work be done or anything elaborate be accomplished immediately. If you will stop for a moment and think what small job it would be to smooth off the rough places or slopes and sow some grass seed, or in southern sections, spot a few pieces of bermuda grass, you would not be long in starting a beautification program around your plant. Water is very necessary in an undertaking of this kind, but the subject we are dealing with being water works would indicate that water was no object.

General Pan of Development.—It is well for the operator who determines to accomplish something along this line to have in mind the following principles which will be outlined, and to prepare in his own way a general plan for the development which he can execute from time to time and gradually expand.

The operator should make a rough map showing the relative locations of the various features on the ground. He should secure sufficient information in regard to the levels to properly drain the grounds and, on this plan sketch out the various features to be added with their ultimate position. He should give general consideration to the grading, driveway, walks, shrubbery, planting, and on more elaborate plans, he would probably go into the matter of flower beds, garden furniture, seats and other features.

Driveways and Walks.—In laying out the general plan one of the first questions will be the driveway, provided the grounds are so situated as to require a driveway. The purpose of the driveway is ingress and egress. It should serve its purpose quickly and be as direct as possible; it is not in itself an ornament but is a utility. On large grounds, it may be one of the functions of the driveway to permit passage through the grounds for the purpose of viewing other features more distant. In such case it may be expanded over greater areas.

The width should be ample, but not excessive. The directions should always be simple and apparently direct. Unnecessary curves and turns are only awkward, not beautiful. The driveway should be located so as not to cut up lawn spaces unnecessarily but should be fitted to the topography and gracefully curve around the existing natural features. If there are no existing natural features, it may be necessary to design a planting of trees or shrubbery to give reason for the desired changes in direction. It is not proper to use a small flower bed, or a small architectural object, or other such things as they are too trivial. The driveway should be from 9 to 10 ft. wide for a single drive, and from 16 to 18 ft. wide for a pass drive. A 12-ft. drive should never be used. It is too narrow for two vehicles to pass and unnecessarily wide for one. There is no beauty in paving surfaces; lawns are to be more desired than the barren driveway.

It will probably be unnecessary to speak of drainage, materials for construction and construction features such as excessive grades, etc., but they should be considered, of course, in a practical manner.

Walks and paths are designed and built on the same determining principles as driveways; there should be some reason for their being, as for instance, to lead to a gate, a door, a seat, or some other feature. Their construction is also similar to driveways. On steep grades, steps can be worked in to advantage; also an opportunity to show

originality on the design of buttresses, walls, etc., is here given. Where a path is seldom used or where a solid walk threatens to cut through a lawn, stepping stones are desirable, set in so the lawn mower will pass over them.

Use of Shrubbery Beds.—Shrubbery beds are used to screen off undesirable views and angle points, border division features and for foliage effects, etc. Shrubbery beds should be shaped to conform to the purpose and location of the bed. The ground plan of the planting should show prominent points and deep bays. The extent of a particular section may be apparently increased by the appearance of distance made by a plantation bay. In planting, strive to get simple, broad effects instead of startling, unusual ones. It is better to secure more restful and peaceful results and impressions than unnatural effects.

Plan to plant in groups and masses rather than in spotting the lawn with individual shrubs. A lawn in which the shrubbery is spotted in individual specimens seems to be much smaller than the actual dimensions, while a lawn with an open center and the shrubbery grouped on the border will have just the opposite effect, and will give the effect of spaciousness. A single row of trees or shrubs for a screen is not so good as a broad mass planting. In planting a group do not arrange the plants in rows or tiers. It is a good plan to observe how Nature masses the shrubs by intermingling the various trees and shrubs. This does not mean that the plants should be shuffled and placed in a haphazard fashion. Observe the natural groups and you will find character and pleasing effects. Nature enables sturdy plants and trees to stand out above the remainder. In planting in groups, individual plants scattered throughout the groups and separated from one another does not give a natural effect. There should be several of each kind of plants in a group and the groups should be blended into other groups.

Balance in Symmetry.—The human eye naturally seeks balance in symmetry. In Nature the idea of balance about some common center is evident. Do not take this suggestion too literally and duplicate individual shrubs about a common axis, but use shrubs of similar habits and similar positions, although not necessarily identical positions. It is not necessary that expensive nursery grown shrubbery be used. It is, of course, more desirable and convenient, if nursery stock could be secured, but very often it is possible to secure native shrubbery from the adjoining woods which, when properly transplanted and cared for, will respond and create some wonderful effects.

Since landscaping is more or less a sideline of mine, I will let you in on some of the secrets of the business. For instance, you are probably all familiar with the so-called buck bush which grows promiscuously in the woods. It is a very simple matter to transplant these successfully with practically no cost. However, when a landscape architect handles the buck bush for the client the name is changed to symphorycorpusresmorus and the cost of the plant is from 10 to 25 cts. each.

The introduction of some pointed pyramidal shrubs or trees, such as lombardy poplars, at salient points gives character and adds interest to an otherwise monotonous planting. Trees should be placed at desirable points for shade and to form vistas. Good judgment should be used in the planting of trees so that, as they grow, they will not interfere with the operation of the water works plant.

The Importance of the Lawn.—There is no feature of landscape planting which is more important to the successful beautification of property than a beautiful lawn. Its importance is seldom appreciated and too often the lawn is not properly considered. It is the foundation and background upon which the various features are placed to form the picture. It harmonizes and ties the various features together with pleasing contrasts. A good lawn is similar to a well dressed person; it is not conspicuous unless deficient. Brown or unburnt spots or weedy patches attract attention to the lawn and minimize the effect of all other features. The lawn will respond readily to treatment and attention.

Too often a lawn is expected to grow on excavated clay and shale or on a thin layer of soil covering piles of rock and building debris. A properly prepared loam bed will repay many times the extra trouble necessary, when the drouth comes late in the summer. The grading of the lawn, apparently is a very simple matter, but is very important to the final appearance.

The topography should be carefully studied and a contour of the lawn should form an integral part of the landscape. It should blend from one elevation to another without abrupt change. A perfectly level piece of lawn with informal and irregular surroundings is entirely out of place. Long, flowing, sloping lines should be maintained. This will also enable the lawn mower to be more easily operated and the lawn to be kept in better condition.

Location of Flower Beds.—It is poor practice to put flower beds or rose beds in a lawn in every conspicuous place. They should be placed along the edges of the scrubbery border in convenient protecting bays. The shrubbery forms a good background and a frame for the blooms, and the maintenance of the grass edges around the flower beds is reduced to a minimum.

Roses are beautiful when in bloom, but in other seasons they are an unsightly group of briers. The best place for roses is a separate area grouped in a rose garden, or along fence or trellis. Roses will do better when protected from strong winds than when set in an open lawn.

For the extensive and elaborate grounds other features may be worked into advantage. Seats conveniently placed are very interesting; pergolas, monuments and statuary all have their place and can be worked in from time to time.

It is the hope of the speaker that the suggestions outlined will enable some operators to at least make a beginning in beautifying the grounds around their water works plants, although on a very small scale, with the idea that the satisfaction and results obtained on this small scale will encourage them to work more and more to the end that before many years the water works plant will be the most important and attractive spot in town and a respected utility.

Mosquito's End Looms in Air Dusting Method

Hope for eventual extermination of the malaria-spreading mosquito and his less dangerous but pesky brethren is seen by Public Health Service authorities in recent results of airplane dusting experiments in swampy areas near Bamburg, S. C.

These experiments are said to have demonstrated the value of the airplane in spreading paris green over large marshes and swamps where drainage or other methods of eradication are impracticable. Navy 'planes with dusting equipment were flown over the South Carolina swamps, releasing the poisonous powder over the mosquitoes' breeding places. At least 90 per cent of the larvae, the investigators estimated, were killed.

Paris green, which contains arsenic, will stay dry and remain on the surface of water at least two hours. In that time the larvae can be expected to come to the top at least once, and are almost certain to receive a death-dealing dose. The method is said to be just as effective against salt marsh mosquitoes as against the malaria-spreading variety, and by repeating the treatment over a period of years the authorities believe that a nearly 100 per cent destruction can be attained.

Public Health Assn. Meets in Chicago

The 57th annual meeting of the American Public Health Association will be held in Chicago from October 15 to 19. A very interesting program and a number of inspection trips have been planned, according to Arthur E. Gorman, secretary.

The Annual City Report

Its Purposes and What It Should Contain

City officials are frequently so busy with other administrative tasks that they overlook the necessity for reporting to the citizens concerning what is being planned and accomplished. Clear and understandable reports are the basis for citizen appreciation of what the city government is, what it is doing, and what it may do. A valuable pamphlet, "Reporting Municipal Government," and discussing and appraising the existing facilities for, and methods of, reporting the conduct of city government, has just been issued by the Municipal Administration Service, New York City. The author is Wylie Kilpatrick, Associate Research Professor of Government, at the University of Virginia. We are reprinting below that portion of the pamphlet relating to the annual city report.

MANY editors of reports view facts, as one observer put it, as "born free and equal." Lest any discrimination be made against some facts, they are included—all of them. But the first essential of the city report should be to discriminate among facts. A charter or law many require the publication of either reports or advertisements; but legal printing may be secured without encumbering the annual report with the deadweight. Large parts of many present-day reports are devoted either to the limited interest of a small public or to the interest of the city employees. Their sole service is to furnish a portly compendium of reference.

Annual Report Should Serve Public.—The annual report should be functionalized to serve the public. The "public" has a variety of shadings. Reporting must therefore follow a variety of methods. Within the same volume the story must be told concurrently in three ways: graphs and charts, statistics, and interpretative comment. And each of these methods achieves value by brevity. Last year President Coolidge took 12 words to decline a presidential nomination that was conceded to him; a month later another leader took 1,200 words to decline a nomination that would have been disputed. No primer of report-writing can be a substitute for a sense of values in determining how a story should be featured.

Editors of city reports are beginning to lift the incidents of import and interest from the bottom of tabular statements and to display them in stories and pictures. For example, the report of Lynchburg, Va., is a readable balance of pictures, tables, and explanatory comment. In a neighboring city, Petersburg, the report is turned into a manual of city government. No person can go through its 85 pages, and the reader is tempted to finish the volume, without an understanding of the structure and operation of a municipality as revealed by a record of one year. A running analysis interprets each office and institution. In the original city manager city, Staunton, Va., the annual report is a record of one-sentence paragraphs. The method of the thumb nail sketch is carried over to reporting the budget, a statement of essential figures with corresponding purposes indicated in one line. Supplementary to the annual report in Norfolk was the recent publication of the volume, The City of Norfolk. Not confined to the government but descriptive of the city's social life, the 24 chapters weave in an explanation of the city services with related aspects of community enterprises. Having first sketched how the city government was simplified and how the city budget is prepared, separate chapters analyze the port commission, the school program, city planning, juvenile and domestic relations courts, and playgrounds. It is not a mere dictionary of facts. Nor does the editor's enthusiasm convert it into a booster's booklet.

The Houston, Tex., Report.—A number of objects are in view in the publication of the Houston, Tex., report, and none of them are jostled in the process. The photographic description of city functions does not subordinate the vivid textual explanation. The volume not only contains summaries of the departments, but two editorials introduce the text by comment upon the trend of civic events. The book opens with full-page portraits of the city commissioners and scattered through its pages are pictures of responsible subordinates.

A serious study in the practice of municipal government is the Milwaukee report. By provision of the city code, preparation of the volume is entrusted to the municipal reference librarian, at present F. N. MacMillin. Throwing the statistics into thirty pages in the appendix, the editor presents a thorough analysis of civic functions, although, unfortunately, in type too small for ease in reading.

Less ambitious but equally thorough, is the summary of each department in the Baltimore annual report. The mayor's budget message properly introduces the volume which recently gained recognition by including reports by the notable city commission on efficiency and economy.

The Yearbook of Boston.—The Boston yearbook achieves the almost impossible task of giving form to the reports of each of a multitude of varied city agencies. The reference qualities of this section of the book are heightened by lifting the statistics and presenting them at the end of the volume. Part two is an unsual attempt to enlist writers, either in or outside the city government, to analyze current civic questions or institutions. After an open hint to elderly gentlemen of wealth who are writing their wills, the section proceeds to discuss the port of Boston, transportation facilities, the market problem, and three articles treat of traffic regulation from, the viewpoint of accidents, control, and rules.

Not content with an annual report, Lynchburg issues a monthly bulletin which informs the city of detailed current operations. Why a monthly report is issued is explained by the city manager of Sewickley, Pennsylvania, J. C. Hiteshew:

"Even though the local editor is willing to give us limited space, we have found that . . . (the newspapers) don't tell things the way we would. They don't misrepresent, but they condense many important things and enlarge upon unimportant ones. To end that we started a municipal monthly."

Manager Hiteshew finds that the activities of this Pennsylvania town have news value. Fire prevention week featured one number. Zoning and parking were the topics of another issue. Then came public health. An examination of the ordinances of the city followed with the dead wood exhumed for exclamation points and the live ordinances listed for observance.

Purposes of City Reports.—The better city reports serve: (1) to set forth the accomplishments of a year's administration; (2) to analyze current civic problems; (3) to describe city government as a social institution; (4) to furnish data for judging municipal officials; and (5) to project a future civic program. Ambitious as are these objects, they are attainable in a moderate degree by enlisting the services of competent reporters and editors. Their realization depends upon both a sense of editorial values and the use of

more acceptable devices for presenting data.

Reporting costs affords a means for comparison between years or between cities. However uncertain may be uniform cost accounting as a basis for exact measurement of results, the unit measure of foot, year and ton are terms into which fiscal statements can be reduced. The weighting of cost units to correct fluctuations between years or localities may be a development of future reporting methods. The use of unit measurement is the immediate end. The trend of governmental expenditures over a period of years is shown in research reports with due allowance for the fluctuation of the dollar. This is a simple device that can be approximated by the adaptation of standard tables, as those of the United States Labor Bureau, even though precision cannot be secured without the formulation of tables for individual cities. The actual trend of public costs then can be related to community income and the degree of absorption of income by taxes—a subject ever giving zest to headlines—can be approximated. Without converting the city hall into a research laboratory, the simpler statistical devices can be employed to penetrate the smoke screen of rumor surrounding current discussion of financial issues.[1] At all events, the "report should not be," as C. E. Ridley puts it, "a pretty picture book jammed with canned propaganda to win an election."

The varied contents of American municipal reports indicate that for the large city, at least, the publication of a single volume is a mistake resulting from an unthinking adherence to obsolete forms. The failure of city reports, if traced to one cause, may be attributed to their attempt to serve too many purposes within a single volume. For the small city, a sectional treatment, and for the large city, the issuance of a series of small books or pamphlets is far superior to piecing together a miscellany of reports and patching book covers around them. Departmental or functional reports are becoming not infrequent. For example, the current report of the Milwaukee Health Department details its activities and performance. In 1926, the city assessor of St. Paul issued a report which is at once a record of his department and a manual on assessing.

Aside from technical publications, the annual city report invites division into several pamphlets. The citizen requires a knowledge of what his city government is and how it is formed structurally. Not every year need the description be repeated in an annual report: occasional publication in a separate pamphlet is preferable. What the city government does forms a current record compelling annual publication. Stripped of unessential statistics, the record becomes a story of local civic life. Something over 100,000 copies were printed of the pamphlet issued by Detroit's mayor and council under the caption, "Detroit's Government, a short story of the services rendered to the people of Detroit by their city government." What the city government may do, a third subject for separate treatment, very generally remains undefined in the minds of officials and voters. Pamphlet publication would serve a function in formulating municipal objectives.

[1]See A. E. Buck, "Municipal Finance," chapters VI and VII on "Cost Accounting" and "Graphic Statistics," respectively.

Work Progressing on Akron Interceptor

Akron's new $3,750,000 sewage treatment plant at Botzum, Ohio, will begin operations the first of the year. The plant itself was completed early this year, but litigation held up work on the large interceptor sewer connecting the plant with the Akron sewer system, and delayed the start of plant operations.

Under the present construction schedule, the two sections of the interceptor sewer, being built along and on a fill of the old Ohio canal through the valley will be finished by Dec. 1. Work is being rushed by the Holmes Construction Co. and the T. E. McShaffrey Construction Co., contractors working on the interceptor.

The sewage will enter the plant through the interceptor at the south end of the treatment unit, where the administration building, shops and garages and other offices are located.

Two meters in the basement of the administration building register the amount of sewage entering the plant, which has a capacity of 33,000,000 gallons a day. Before passing through the meters the sewage passes through two detritus tanks, which take out all grit, grease and trash.

Settles in Tanks.—The Imhoff tanks, 24 in number, first receive the sewage. The sewage settles in these tanks, and all suspended organic matter goes to the bottom and decomposes.

From the Imhoff tanks the fluid sewage goes to the filter beds, 14 acres in extent, formed of 6,000 carloads of crushed limestone, spread 10 feet deep. The fluid sewage is sprayed out over these beds, through a pipe system, controlled from four dosing tanks located at spaced intervals on top of the limestone beds. These tanks are automatic, filling up and discharging through the pipes at regular intervals.

The material deposited at the bottom of the Imhoff tanks is drawn off at regular intervals and goes to the sludge beds, four acres in extent, located next to the Imhoff tanks. The material dries out on top of the sludge beds and is taken away to the dump. A complete network of tracks covers the sludge beds, used in carrying away the dried material.

The final step in the treatment of the fluid sewage is the passage into the secondary settling tanks, where the solid picked up in the trip through the other parts is allowed to settle, and the sewage when it leaves the plant to flow into the river, is practically free of all organic matter.

All the land around the plant is being landscaped, and in another year, lawns and terraces will completely surround the entire plant.

New York Has New Traffic Signals

A new traffic light system in West End Avenue, from Sixty-third to 106th Street, in New York City, was recently turned over to the Police Department by Commissioner Albert Goldman of the Department of Plant and Structures. The posts, control apparatus and lanterns were designed by the Department of Plant and Structures to conform with the equipment used in other streets.

The cost of the system was about $14,000. Ten miles of wire were used in making connections. Police protection for the forty-three intersections involved would amount to $215,000 a year, while maintenance of the signals will be less than $3,000 per year.

Thirty-one signal lights controlling traffic at 104 street intersections were installed in Lexington Avenue recently. Fifteen other signals were placed in service on Liberty Avenue, Brooklyn, at about the same time.

Work on signal systems along Avenue A, Riverside Drive, Lenox Avenue, Madison Avenue and Upper Broadway, Manhattan; Flatbush Avenue, Brooklyn, and Southern Boulevard, Boston Road, East Tremont Avenue and Prospect Avenue, the Bronx, is rapidly progressing and will be soon completed. As systems are completed, cables are being extended to a central control station at West Thirtieth Street, between Sixth and Seventh Avenues, Manhattan. Five systems have been extended to the control station.

Water Works Men Meet in Huntington

The Central States Section of the American Water Works Association met in their 30th annual convention in Huntington, W. Va., on August 23 and 24. The sessions were held at the Prichard Hotel. Well known men discussed such subjects as Pitometer water waste surveys, water purification, corrosion, valuation and rate making, and other topics of interest. E. E. Bankson, of Pittsburgh, is secretary-treasurer of the section.

Filter Plant Operating Kinks

Methods and Devices Used by Ohio Plants

ONE of the most interesting features of the last annual conference of Ohio engineers and operators of filtration plants was the progress reports on filter plant operation, and the discussion of the various miscellaneous problems confronting the operator. In this discussion some interesting methods were brought out which we are describing below, our information being taken from the recently issued seventh annual report of the conference.

Mechanical Control of Wash Water Application.—At Bellaire, O., filters are washed directly from the high service pump discharge. E. J. Lewis, chief engineer of the water works, has developed and installed a wash water control valve, hydraulically operated and located on the main wash water line where it enters the pipe gallery. Each individual filter has a wash water valve which is hand operated. In washing a filter these individual wash water valves are difficult to open, due to the high pressure maintained, and if these valves were opened before the hydraulic control valve there would be too great an inrush of water in the filter with the possibility of overturning the filtering material. To guard against the possibility of the operators washing filters in this way, a "foolproof" control device was placed on the hydraulic valve so that it will open slowly and close slowly. The length of time it remains open is also mechanically controlled for any predetermined period. By setting the device it is possible for the filters to be washed properly by any operator, and the superintendent knows that there is no danger of overturning the gravel and sand even though he may have a more or less undependable operator. The device is shown in Fig. 1, and may be described as follows:

A small tank T of about 2 gal. capacity has a fixed overflow and an orifice in the bottom adjusted by valve G to empty the tank in a given length of time through waste line K. In the accompanying diagram the main wash water control valve L is closed and water flows from a pressure line connection through a 4-way valve I, through line N to top of hydraulic cylinder and through valve S into tank T either through the top or the bottom orifices. The flow into tank T is continuous until the 4-way valve settings are changed. Water runs to waste from tank T through the overflow line.

When ready to wash a filter the wash water valve on the filter is opened wide. Then the setting of the 4-way valves of the control device is changed by raising lever A until notch B engages pawl C. This connects the pressure line into the under side of the piston in the hydraulic cylinder through 4-way valve I, and valve L begins to open. Water from above the piston in the hydraulic chamber flows through line N, through 4-way valve I, through valve H and 4-way valve J to waste line P. The rate of opening of the valve L is governed

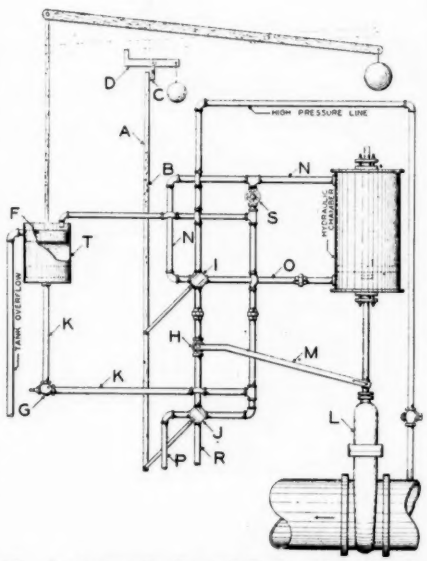

Fig. 1—Automatic Control Device of Hydraulic Wash Water Valve at Bellaire, O.

by the rate at which waste water will flow from the upper side of the piston in the hydraulic cylinder. It is controlled by the valve H which begins to open as the stem valve L rises, valve H being connected to the stem of valve L by lever M. Valve L remains open until the setting of the 4-way valves is returned to the position shown in the diagram. The length of time the valve is held open is governed by the length of time it takes for tank T to empty through the orifice in the bottom and it is regulated by valve G for any predetermined period. As water flows out of tank T through line K, valve G, 4-way valve J, to waste R, the float F drops, trips lever D and disengages pawl C from notch B in lever A, which drops to position shown in diagram.

The rate of closing of valve L is governed by the rate at which waste water from the under side of the piston in the hydraulic cylinder discharges. This is controlled by the valve H in the reverse manner in which the rate of opening of valve L is controlled.

Tank T again fills from the pressure line and through line K from the under side of the piston in the hydraulic cylinder and float F assumes position shown in the diagram, which completes the cycle.

Detection of Condenser Leakage by the Bacterial Method.—The Toronto plant of the Penn-Ohio Power & Light Co. is one of the largest electric generating plants in the state. The plant is equipped with steam turbine driven generators and condensers through each of which 86,000,000 gal. of river water are pumped daily. Some idea of the size of the plant may be gained from the fact that entirely within the building there is a 3 m.g.d. water purification plant which consists of mixing chambers, coagulation basins, filters and clear well. The filter plant is under laboratory control and the quality of water meets the U. S. Public Health Service standard of purity.

In the operation of a power plant of this kind the detection of small amounts of leakage in the condensers is most important from an economic standpoint. Several methods of making tests for condenser leakage have been in general use in industrial plants. They may be enumerated as follows: (1) The test for chlordies by silver nitrate; (2) the test for hardness by soap solution; (3) The test for conductivity by a potentiometer. These tests are all useful, but have the disadvantage of not being very sensitive for a small amount of leakage.

The idea was conceived by L. W. Radman, the plant chemist, that as the superheated steam reached a temperature of 670 deg. C. the condensate should be sterile, and that if any of the condenser tubes were leaking, permitting raw river water to enter the cosdensate, that even slight contamination would be indicated by its bacterial content. Accordingly bacterial counts were made daily on water from each condenser for some time without any bacterial growths on agar plates. To check the results condenser No. 1 was shut down and was found to have no leaks. The agar plate counts were continued. After six weeks the condensate from condenser No. 2 was found to have a high bacterial content which indicated leakage. As the engineer was unable to note any change in the amount of make-up water required for this unit, it was continued in service until bacterial counts for two more days confirmed the previous finding. The unit was shut down and tested. Of the 9,450 tubes in the condenser it was found that 6 had very small leaks which would probably not have been discovered by any other method.

On account of the extreme sensitivity of the bacterial method of testing for condenser leaks it is being used regularly in this plant.

Automatic Altitude Valve for a Wash Water Tank.—The original layout of the East Liverpool plant included a 4-in. pressure line controlled by a float valve for filling the wash water tank. The valve was submerged and considerable difficulty was experienced with the float. The tank was continually running over due to the valve not functioning. D. H. Rupp, the former superintendent of filtration at the plant, installed a Golden-Anderson altitude valve in the pipe gallery of the filter house to overcome these difficulties. The altitude valve is a 3-in. valve which connects a 4-in. pressure line with the wash water line. It is joined to the wash water line by a friction connection held in place with bolts. When operating, the wash water tank is filled back through the wash water line. The upper side of the diaphragm of the altitude valve is connected with the wash water line at a point above the valve.

In operation the altitude valve is simple. The pressure from the wash water tank working on the diaphragm actuates an auxiliary high pressure pilot valve, which in turn opens and closes the sliding piston in the main part of the valve thereby allowing the tank to fill to a predetermined level. An adjusting nut on top of the valve permits its operation very quietly and controls the level of water to within an inch or two. It has given no trouble since it was installed.

Should Trees Be Allowed to Grow Adjacent to Impounding Reservoirs?—The question here raised was in regard to the effect of having deciduous trees growing so close to reservoirs that the fallen leaves would affect the color of the water and thereby increase the difficulties in purification process. T. H. Tristram spoke of his experiences at Wellington in this connection. An effort has been made at Wellington to keep the growth of trees and bushes down to a minimum around the reservoir, and with the cleaning up of the banks of the reservoir a reduction has been noted in color of the water.

At Blanchester the supply is from an up-ground reservoir. There are four poplar trees nearby and it is surprising how many leaves get into the water and cause a black slimy deposit on the reservoir bottom, Mr. Bahlman reported.

Reforestation projects are being conducted adjacent to several water supply reservoirs in the East. The New York City supply reservoirs are heavily planted with pine and spruce. A large reforestation program has been started around the reservoirs of the Scranton, Pa., Water Co. The use of evergreen trees near the water's edge tends to keep leaves of deciduous trees out of the reservoirs. In Ohio reforestation work has been started by the Akron waterworks. The work which is being done there might well be done at many places throughout the state where the water department has extensive land holdings for well sites or reservoir purposes. J. S. Gettrust described the reforestation at the Akron water supply reservoir as follows:

"It is planned to set out 500,000 trees around the water supply reservoir. Four hundred acres are to be used in this reforestation program. Seedlings are obtained free of charge from Edmund Secrist, state forester, at the experiment station at Wooster. The only cost is transportation. There have been 200,000 seedlings about 6 in. high already set out in a nursery. They are set 8 in. apart in rows 3 ft. apart. After being in the nursery three years they will be planted. Trees will be set out in rows 6 ft. apart each way, making 1,200 trees to the acre. Most of the trees are evergreens, consisting of Scotch pine, white pine and red pine, which predominate. Some Corsican pine and Norway pine have been set out. Some deciduous trees are being used, such as the tulip poplar, swamp white oak, upland white oak and black walnut. These trees will not be large enough for merchantable timber for 50 years or more. Besides the trees for reforestation there is adjacent to the reservoir a wonderful fruit orchard consisting mostly of apple trees. Upon the property purchased for the reservoir there were orchards containing 1,000 trees. Nine thousand new trees have been set out and 4,000 more are to be planted to complete the orcharding program. The operation of this fruit orchard requires the services of a trained horticulturist. The fruit farm has proved a profitable investment for the waterworks and it improves the appearance of the grounds adjacent to the reservoir."

What Cities Are Making Routine Tests of Tap Water for Comparison with the Plant Tests, and What Do These Tests Show?—At Cincinnati there are two large open reservoirs on the city distributing system. A part of the city is supplied with water direct from the filtration plant. The bacterial count and the B. Coli index is invariably higher in samples of water collected in the downtown part of the city than in samples collected from the plant or from that part of the system which is supplied directly from the plant. Analyses of samples from the city taps are made regularly.

At Toledo samples of water collected from city taps showed a higher bacterial content than the plant samples and B. Coli were also more numerous. The reservoirs on the system are covered and the increase cannot be explained, but it was remedied by introducing chlorine at two points. The initial application is to the plant effluent. The second point of treatment is at the high service pump station about 2 miles distant. As the total quantity of chlorine applied is the same as when the single point of application was used it is not in any sense to be considered as double chlorination, but rather as split chlorine treatment. Since starting this treatment city tap samples have had a B. Coli index of zero.

At Cleveland samples of city tap water are analyzed occasionally by the water department, but tap water is checked more or less regularly by the city health department. The B. Coli index is greater in these samples than in the water as it leaves the filter plants. Some reservoirs on the system are open and liable to contamination from the air, small animals and birds. This may account for the bacteriological results. But why there should be an increase in bacteria in remote parts of a distributing system, particularly on small pipe lines and dead ends has never been satisfactorily answered, Mr. Ellms stated.

At East Liverpool, Mr. Rupp stated, tests were made of city tap samples during periods when the raw water had a high B. Coli index. In those samples a lower B. Coli index was found than in the plant effluent samples. He ascribed this to the longer period of contact of the chlorine.

Mr. Waring summed up the above remarks by saying that where open reservoirs were on the distributing systems analyses of tap samples were valuable. All reservoirs should be covered, he said, to obviate the pollution of the water by air borne pollution such as was experienced at Cincinnati and described in detail previously by Mr. Bahlman.*

What Is the Proper Size for the Inverted Tube in the Fermentation Tests?—The question was raised by A. B. Cameron as to whether there is any relation between the size of the inverted tube in fermentation tests, and the amount and rate of gas produced in the invert. The sizes of invert tubes vary considerably. It seemed to be the consensus of opinion that the size of the tube had very little to do with the percentage of gas production. Several of the members do consider that some provisions should be made to provide a free opening between the inverted tube and the large tube. At Youngstown all inverted tubes are heated and lipped with a file. At Cleveland all invert tubes are beveled. At Toledo during the past year invert tubes of a different size than those formerly used were purchased. Mr. Furman reports that the average percentages of gas produced seem to be unchanged and that the size of the tube is unimportant.

Can Crushed Stone or Slag Be Used for Supporting Medium for Rapid Sand Filters?—This question was raised because of the ease of obtaining crushed rock and slag, whereas good gravel is often difficult to obtain.

Mr. Furman stated that some small softening installations in Toledo were provided with crushed stone over the

*Sixth Annual Report of Ohio Conference on Water Purification, p. 86.

under drains. Crushed brick was used in one case. The only objection he found was that the smaller sizes could not be graded satisfactorily on account of too much packing. For the larger sizes he said crushed stone has been used with good results in the plants using lime softening No difficulty has been encountered in washing these filters. These plants were all of less than 50,000 g.p.d. capacity so the results should be considered merely as experimental.

At Sebring the gravel is composed largely of "flats" and Mr. Hess thought that crushed rock would be fully as good. No particular difficulty has been experienced due to this supporting medium, but he concludes that almost any kind of stone would have been as satisfactory.

Mr. Ellms is of the opinion that the smaller sizes of crushed rock would undoubtedly have more of a tendency to pack than gravel. The voids in crushed rock would probably be smaller and when a filter is washed he thinks there would be an increased tendency for the wash water to break through in certain places, leaving areas in the stone which would not get the full effect of the upward flow of the water, and in consequence might develop hard spots. As for the use of slag as a supporting medium for sand in filters, Mr. Ellms raised the question whether its sulphur content might not have a corrosive effect on the underdrain system if it was constructed of iron pipe.

At Sandusky where there is more filter capacity than is required, and where one filter needs to be rebuilt it was indicated by Mr. Schoepfle that a crushed rock or slag supporting medium might be used in it for making an experiment of its practicability.

Supplementary Clauses to Model Traffic Ordinance

In our July issue we printed the tentative draft of the model municipal traffic ordinance, prepared by Committee on Municipal Traffic Ordinances and Regulations of the National Conference on Street and Highway Safety.

In considering the subjects that have been suggested for possible inclusion in the model ordinance, the committee reached the conclusion that some of them could best be treated in separate ordinances. The committee therefore submitted three suggested ordinances providing respectively for the organization of an official traffic commission, the creation of a traffic engineering department and the control of street obstructions. The committee commented on the first two subjects as follows:

Official Traffic Commission.—Every municipal government has as one of its functions the protection of life and property on its streets. The fulfillment of this duty involves the activities of the local legislative, administrative and judicial officers. There is need for appropriate co-ordination between all municipal agencies responsible in the matter of traffic regulation, control and enforcement.

It is recommended that every municipality faced with serious traffic problems create an official traffic body made up of public officials. Membership on such body should, for example, include a member of the city legislative body, a judge of the traffic court, representatives from the street, police and legal departments, and also a representative from the park department if it has any jurisdiction in traffic matters. Such traffic body should advise the city council and the administrative departments of the municipality as to the best methods for administering street traffic regulations and as to improvements and changes requisite for the reduction of accidents and congestion.

Division of Traffic Engineering.—It is also recommended that such municipalities establish a division of traffic engineering and employ a competent city traffic engineer. The city traffic engineer should be a member of any city traffic body established as above suggested. He should conduct studies of street traffic accidents and congestion and of all conditions affecting the safe and convenient use of the streets, collect facts regarding the effect and operation of regulations controlling street traffic, and advise as to the placing, maintenance and operation of traffic signs and signals erected throughout the municipality. He should work in close co-operation with the chief of police or head of the traffic division of the police department.

The suggested ordinances follow:

AN ORDINANCE TO CREATE AN OFFICIAL TRAFFIC COMMISSION

It is ordained by ( ) as follows:

Section 1. Official Traffic Commission Created. An official traffic commission is hereby created for the city of ( ) to consist of the following officials: The Mayor; a member or representative of the (city council), to be selected by the (city council); the (street commissioner or commissioner of public works); the (corporation counsel or city attorney); the (superintendent of police or chief of police); the chief justice of the municipal court; the city engineer; a representative of the city planning commission, to be selected by such commission; a representative of the park commission, to be selected by such commission; and the traffic engineer.

In the event that any department authorized above to select one of its members to serve upon the official traffic commission shall fail, neglect or refuse to appoint such representative, then the other members of said official traffic commission designated herein shall constitute the official traffic commission.

Section 2. Duties of the Official Traffic Commission. The official traffic commission shall advise the (city council), the administrative departments of the city, and the departments and organizations represented upon said commission, of the best methods for the administration of street traffic regulations and of the improvements and changes, both legislative and administrative, requisite for the reduction of street traffic accidents and to relieve traffic congestion.

The official designations inserted above and included in brackets are suggestive of the appropriate officials to be appointed on the traffic commission. A municipality upon adopting any such sections should insert the correct designation of the appropriate public official, board or body.

AN ORDINANCE TO CREATE A DIVISION OF TRAFFIC ENGINEERING

It is ordained by ( ) as follows:

Section 1. Division of Traffic Engineering Established. There is hereby established a division of traffic engineering which shall be under the jurisdiction of the (commissioner of public works, city manager, superintendent of streets) and form a part of the (bureau of streets, street department). The division of traffic engineering shall consist of a competent traffic engineer, who shall be known as the city traffic engineer, to be appointed by the (commissioner of public works, superintendent of streets) pursuant to law, and such other employees as the said (commissioner or superintendent) may deem necessary.

Section 2. Duties of the City Traffic Engineer. It shall be the duty of the city traffic engineer to conduct studies of street traffic accidents and traffic congestion, and other conditions affecting the safe and convenient use of the streets; to collect facts regarding the effect and operation of regulations controlling street traffic; to supervise the placing, maintenance and operation of traffic signs and signals erected by the (department of public works or street department); and to perform such other duties as may be ordered by the (commissioner of public works or street superintendent).

AN ORDINANCE TO CONTROL ROADWAY AND SIDEWALK OBSTRUCTIONS

It is ordained by ( ) as follows:

Section 1. Street Openings. It shall be unlawful for any person, firm, or corporation to conduct any work in streets involving obstruction to traffic, except in the manner and at the times herein provided, as follows:

(1) Permits for work involving obstruction to traffic must be obtained from the (street department, police department) in addition to any other permit required by law.

(2) The distribution of the material or equipment incident to the work shall at all times be such that the minimum number of traffic lanes will be obstructed.

(3) In those sections of any street where parking is prohibited, openings or the temporary storage of materials or equipment which prevent the free use of any portion of the surface will be permitted only between the hours of 6:15 P. M. and 8:00 A. M.

(4) In those sections of any street where parking is permitted for specific periods of two (2) hours or less, openings of the temporary storage of material or equipment which prevent the free use of any portion of the street surface between the hours of 8:00 A. M. and 6:15 P. M. will be permitted only where the work is carried on for at least sixteen (16) hours per day during the time the street is obstructed.

(5) During the period in which a portion of any street is obstructed by an opening or by the temporary storage of material or equipment, there shall be maintained, under the direction of the police department, temporary signs prohibiting parking between points located fifty (50) feet from each end of the work.

Section 2. Hoisting Materials. It shall be unlawful for any person, firm or corporation to hoist steel or building material from any street or from any vehicle standing therein, between the hours of 8:00 A. M. and 6:15 P. M., in such a way as to obstruct or endanger either pedestrian or vehicular traffic in those sections of any street where parking is prohibited.

Section 3. Storage of Materials and Temporary Sidewalks. It shall be unlawful for any person, firm or corporation to temporarily store any material or equipment or to place and maintain a temporary sidewalk in any roadway in those sections of any street where parking is prohibited between the hours of 8:00 A. M. and 6:15 P. M.

Section 4. News Stands, Rubbish Boxes, etc. It shall be unlawful for any person, firm or corporation to place or maintain a news stand, rubbish box, merchandise stand and/or similar obstructions within twenty-five feet of any street intersection.

Cost of Operating Water Department Storeroom.—In the annual report of the operations of the Engineer Department of the District of Columbia for the fiscal year ended June 30, 1927, Mr. J. S. Garland, Superintendent of the Water Department, stated that the total cost of operating the storerooms and yards of the department for the year was 3.424 per cent of the value of the material plus value of equipment disposed of.

The Management of Water Works Business from the Executive Office Standpoint

An Interesting Discussion of the Business Affairs of a Water Department

By GEORGE H. FENKELL

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THE first essential element in a successful waterworks department is in the employment of a staff of competent workers. The management of a privately operated plant is usually free in the selection of employees, and in the establishment of the salaries that will be paid, but in many municipally operated water works but little attention has been given to the qualifications of the applicant when filling a position. Through the operation of a civil service department having adequate legal authority, and administered by business men who have had experience in employment affairs, it is possible to remove to a considerable extent the difficulties that prevail when employment is used as reward for political services rendered. The establishment of the civil service system, based primarily on the prevention of interference for political or religious reasons in the filling of positions and in making promotions and demotions, marks an important step in promoting efficiency in a municipal water department. The spirit of common devotion will also be improved through the adoption of a system of old age pensions for employees.

The Engineering Force.—A second subject of primary importance is the maintenance of an engineering force that will alow the design for extensions and improvements to be made well in advance of the time that these will be needed in operation. The weakest part of many municipal water projects is the engineering staff that is available for design. When a structure is needed that will require three years to build, with the work carried on in an orderly way, and which can be completed in one year as a rush order, it may be expected that there will be a saving of 25 per cent or more, through the use of more leisurely methods, because the additional time will allow the development of better design, the material can be purchased to better advantage, and labor can be directed in a more economical manner. Even in a well organized department it may be found impossible to solve each problem that arises in a satisfactory manner, and hence the employment of a consulting engineer or waterworks specialist will not only become desirable but necessary if the best results are to be obtained.

The framers of a city charter do not usually contemplate its use as the basis of control for the formation of an organization and for the operation of a construction bureau to carry through to completion projects of exceptional magnitude. Many city charters, however, contain a provision which requires that a contract shall be awarded to the "lowest responsible bidder." The operation of this clause has been objected to by many engineers, but when all things are considered, the writer believes that this is a safe method of procedure to be followed by a municipality.

Centralized Purchasing of Supplies.—Through the use of a department or bureau of Purchases and Supplies it will frequently be found possible to effect substantial savings in the purchases of material. The director or officer in charge of this department has no sinecure. A disadvantage results from centralized purchasing of supplies because of the tendency that it produces for the engineers in the staff of the water department to become less well informed as to what material and equipment can be made available for use, but the gain through the use of such a department is much greater than the loss that it occasions. Many kinds of supplies that are used in a water department are of bulky nature, but if purchases are made in quantity, and if advantage is taken of the low prices that prevail at those times when the manufacturers are eager for orders, substantial savings may be effected, provided adequate and well located storage space has been developed.

Charges for Water Service.—The principal source of revenue for the municipal waterworks department will come from the sale of water, and the charges for water service may be based on measurement by meters, upon rates based upon the number and type of fixtures used, upon rental value of the property served, or a combination of two or more of these. The use of rental value as a measure in determining charges for water is used but seldom if at all in the United States. The use of meters has increased rapidly in the last few years, and while some cities still continue to make collections according to the flat rate or assessment system, the fact remains that many communities are adopting the meter system as the most equitable for the consumers as well as to the works, and of these that have adopted this method for determining charges, not one, as far as the writer knows, has returned to the flat rate system after meters have once been placed in use. While the cost of operating a meter system may be as great as one without meters, it will usually be found that through the use of meters capital investments are reduced and water service improved. As the filtration of water increases its cost and its value, the installation of filtration plants tends strongly to bring about the early metering of the services supplied.

Methods for Reducing Water Waste.—Methods other than by the use of meters are available for use for the reduction of waste and for determining the plans that should be used for strengthening a water system. Among those that are easy to employ are—(a) Measurement of the supply through the use of Venturi meters; (b) leak surveys by water taken from hydrants and used to feed one block at a time through a hose line; (c) pitometer leak surveys; (d) surveys of the flow in large mains by the use of pitometers; (e) hydrant surveys to determine the amount of water available for the fire department at any point; and (f) the use of a number of pressure gauges read hourly and located at several points in the distribution system.

Emergency Crews.—No water department is so small that it does not need to have at least one emergency crew that can respond promptly when a break in a main occurs, for the broken main is the bane of the waterworks management. It usually occurs without warning and without previous knowledge of the time or place where it will occur, and unfortunately the cause for the trouble can seldom be determined later. To maintain men in idleness, subject to call at all times but seldom responding to emergency calls, is uneconomical and will cause their undoing. A plan that has proven satisfactory in some cities is to divide the work of the garage crew into three shifts, to use the garage as an emergency station and the auto repairmen and washers as emergency men for use at those times when serious trouble occurs.

During the past few years there has been a marked increase in the cost of labor and material, but through economies that have been effected by efficient management it has not usually been necessary to increase water rates in the same proportion. However, there has been a considerable increase in the cost of producing water, and this

should be reflected through an increase in water rates in order that the proper balance between capital and income may be maintained. This income should be sufficient to allow the department to operate well, to maintain it in good condition, to pay off annually at least a part of the outstanding debts, to meet the interest when it becomes due and the financial requirements of the sinking fund.

Determination of Water Rates.—There is a great difference in practice in the methods employed in the determination of the water rates in the different cities where meters are used. Some cities charge a uniform rate regardless of whether the quantity furnished is large or small, usually with a minimum charge. When the municipality owns the meters, a meter rental is also frequently charged. Some cities have a variable rate, depending upon the amount of water used by the consumer, and the use of a three step rate is increasing. Service charges which will cover all or part of the unvarying expenses of water service are coming into more general use, as it is believed that this plan is fundamentally more just to the works and to the consumer.

Additional Source of Revenue.—In addition to the funds that will be secured through the sale of water, additional amounts may be obtained through an assessment against the abutting property for the construction of the distribution mains. Collections through this assessment method have not been generally employed, for some cities lack the necessary authority to make such assessments, and in others because of the slow growth of the system, the establishment of such a method for the securing of additional revenue is not justified. This plan for collecting a part of the cost for extensions is recognized as a reasonable one, and the funds that are collected are of substantial assistance in the financing of new projects.

In the collection of income tax from employees of municipal plants, the United States Government has assumed that the function of the water department is proprietary rather than governmental. If the Treasury Department is correct in its ruling and the function of such a water department is proprietary, then it should collect from the city it serves its regular charges for all services rendered the municipality. This would include charges for fire service, for water furnished parks, fountains, municipal buildings, for street sprinkling and flushing, and for charitable institutions of all kinds. The department in turn would be expected to pay taxes the same as any private utility. It has been assumed by many that the free service rendered a municipality is offset in the department by freedom from taxation. It should be remembered however, that there is a difference between the taxpayers and the water consumers, and further, that water service that is rendered free is used with but little attempt to control its use and to reduce its waste.

The management of a privately owned water plant is concerned principally in maintaining the value of the property and in the payment of dividends. The management of a municipal plant is concerned with developing and operating the plant in the way that will best satisfy the citizens and water consumers and in turning back to the plant for capital investments the surplus which is the result of the economies effected through efficient operation.

Private and Municipal Developments Compared.—As the greater number of the water plants in the United States are owned and operated by the municipalities that they serve, it may be inferred that inherent advantages are obtained by serving a community through a municipal department rather than by a privately owned company. While there is no intention to discuss here the complicated problem of private vs. public ownership, the writer ventures to point out some of the advantages of each that affect the business of the departments.

Private management allows: (a) Better control of employees; (b) the payment of salaries somewhat commensurate with the work performed, and hence the employment of those more nearly suited to fill important positions; and (c) prompter action for meeting new conditions of service.

The municipally operated department can: (a) Secure funds at a low rate of interest; (b) operate with expenses for legal services and for litigation reduced to a minimum; and (c) build structures of a more permanent nature than would be possible for a company to construct that operates under a limited franchise.

Few New Uses for Product of Water Department.—There is no single item by which the management of the municipal plant can be judged. The business affairs of a water department differ from those of other public utilities and nearly every other kind of business, in that there are few new purposes for which water can be used. By way of illustration, reference may be made to electric light and power companies, and the gas companies, which have extended the use of their products into fields that were quite foreign to them a short time ago. A few years ago hydraulic elevators and water driven washing machines came into limited use, but the amount of water used for these purposes now is very small. The cooling of the air in retail stores and theatres through the use of appliances requiring cooling water has been used to a limited extent, but with all of the methods that use water in new ways the amount required is almost negligible.

Retaining Good Will.—As a water department usually has a monopoly in the community which it serves, and as the new uses for its product are few, it does little advertising and maintains no sales department. In this respect it also differs from nearly every other kind of business. It is essential, however, that the department maintain the good will of the consumers, and the only channels open for doing this are through the maintenance of the visible portions of the plant in a sightly condition, the rendering of good service and the publicity of its aims and endeavors. The reputation that the department enjoys will be no less due to the promptness anl courtesy of employees and the speedy adjustment of its accounts and complaints, than to the excellence of its mechanical equipment and the adequacy of its supply of a wholesome product.

There is little use in collecting and summarizing data unless some good use is made of them after they are collected. The records in the department are collected, preserved and summarized;—(a) To make possible the prompt collection of all the monies due the department; (b) to determine when payments must be made and the amount of the bills that must be met, and to pay all bills when due; (c) to keep down the cost of plant operation and maintenance, and (d) to determine the future needs of the department in such a manner that the construction requirements will be met in the best and cheapest manner.

Financing and Administering Sewers.—Many cities find difficulty in securing funds needed for essential improvements through the limitation established by law or otherwise. However, owing to the elemental need of an adequate supply of wholesome water, laws regulating the finances of a city are usually less restrictive with the financing of water projects than for other improvements. Principally because of this difficulty in securing funds, consideration has been given recently to the proposal that the portion of the sewer system that is concerned principally with the dry weather flow be financed and administered by the municipal water works. To what extent the sewer system would be so financed and operated would depend upon legal and financial restrictions of the communities in question, and also on local usage and municipal laws. With some, the entire sewer system would be included, while in others storm water sewers would be excluded. Whether or not sewage treatment works would be included would depend upon local circumstances. In the establishment of tax rates, as well as the rates to be charged by public service corporations, the word "equitable" is used freely and without a realization that "ability to pay" is often the deciding factor. As the sewers that carry away the dry weather flow operate in conjunction with and are a necessary supplement to the water system, and as most of the water sup-

plied is removed through these sewers, and as the demand for sewer capacity is in almost a direct ratio to the amount of water used by the consumer, it appears reasonable that administration of the affairs of the sewer system can, in some cases at least, be joined with that of the water department. Objections to the adoption of such a plan would probably be raised by railroad companies which use large quantities of water for locomotive boilers, and by some others, but the number of these would be relatively few. While no general rules on this subject can be stated now, it seems quite certain that within the next few years this method of financing and operating sewerage systems will be given increasing consideration by the governing bodies in many cities.

Fire Protection Demand.—A well operated water plant is a great asset to a community for a number of reasons that are apparent and which should be appreciated by the consumers. Its effect in accomplishing a reduction in fire insurance rates, or in maintaining low rates already established, is at present generally intangible. It is to be regretted that the fire insurance companies have not found it convenient to evaluate improvements needed for fire prevention purposes.

Excepting those that have given the subject careful consideration, few realize to what an extent the demand for fire protection service influences the design and cost of a waterworks system. "Experience has shown that the cost of the portion of the waterworks involved by fire protection service in this country generally constitutes from 60 to 80 per cent of the entire cost of the physical property in the case of communities having less than 10,000 population; 30 to 40 per cent in communities of about 50,000 population; 20 to 30 per cent in communities of about 100,000 population; and 10 to 20 per cent in the case of our largest cities." *

Finally, the prosperity and growth of a city will continue to be contingent to no small degree on the excellence of the water works system and the reasonableness of its water rates. In the coming years it will be found that to maintain the works at a high degree of efficiency and to furnish water at rates that are consistent with the capital costs and other expenses involved, the ingenuity of the waterworks management will be taxed to an ever increasing degree.

Acknowledgment.—The above is an abstract of a paper prepared by Mr. Fenkell and read at the annual convention of the American Waterworks Association by D. C. Grobbel, chief clerk and acting secretary, department of water supply, Detroit.

*Water Works Manual, page 593.

Canada Preserves Historic Sites

The Department of the Interior of Canada has been carrying on the work of preserving and restoring historical ruins and suitably marking the sites of historical events. On the recommendation of the Historic Sites and Monuments Board the department through the National Parks Service, has marked 118 sites by the erection of memorials. Each year at the annual meeting of the board the suggestions of members are reviewed and a number of sites are recommended for marking.

In 1927 tablets were placed on twenty-five sites. One of the most picturesque ceremonies was the unveiling of the cairn and tablet at Blackfoot Crossing, near where the Cluny-Milo section of the Alberta Provincial highway crosses the Bow River. This memorial commemorates the signing, on Sept. 22, 1877, of Treaty 7, by which the wide plains were thrown open to the white man and peace was assured to the Indians. The Indians relinquished their claim to 50,000 square miles of fertile prairie in Southwestern Alberta by this treaty.

Indian treaties signed in each of the other Prairie Provinces, Manitoba and Saskatchewan, are also to be commemorated. Treaty 1 was signed at Lower Fort Garry, Manitoba, on Aug. 3, 1871, and Treaty 6 at Fort Carlton, Sask., between Aug. 23 and 28, 1876, and at Fort Pitt on Sept. 9, 1876.

Recently the 1928 meeting of the Historic Sites and Monuments Board was held at Ottawa. One hundred and ten sites were reviewed and a number were selected to be marked as of national importance. Brig. Gen. E. A. Cruikshank, a recognized authority on the military history of Canada, who is Chairman of the board, presided.

Of the new sites or events selected for commemoration the following are outstanding in the official list:

"Hillsborough, N. B.—Site of the Battle of the Petitcodiac, August, 1755. This was the last action in connection with the removal of the Acadians.

"Sydney, N. S.—Political reunion of Cape Breton and Nova Scotia, Oct. 16, 1820.

"St. Johns, Quebec—Site, near here, of the Battle of Montgomery's Creek, Sept. 6, 1775, with Montgomery's invading army. The defeat of the invaders had the effect of repelling a formidable invasion for the time being and created great enthusiasm in the country.

"Nanticoke, Haldimand County, Ontario—On Nov. 13, 1813, the Norfolk Volunteer Militia routed a band of marauders that had terrorized the country. This exploit inspirited the military forces, restored the confidence of the people and was an important factor in the immediate recovery of lost ground.

"Fort Drummond, Queenston Heights, Ontario—Fort built by military labor for the defense of the frontier in 1814 and named in honor of Sir Gordon Drummond.

"Niagara-on-the-Lake, Ontario—Commemorating the treaties concluded with the Chippawa and Mississauga Indians by Colonel Guy Johnson, May 9, 1781, and Lieut. Col. John Butler, May 22, 1784.

"Kingston Navy Yard, Kingston, Ontario—The British naval station for Lake Ontario during the years 1788-1818. Here were built fourteen ships. In the War of 1812-14 this naval station enabled the army to retain control of Upper Canada.

"Amherstburg Navy Yard, Amherstburg, Ontario—The British naval station for Lakes Erie and Huron during the years 1796-1813. Here nine King's ships were built. In the War of 1812-14 this naval force enabled the army to retain control of that frontier.

"Fort Fork, Alberta—Situated near the junction of Great Smoky and Peace Rivers and erected by Sir Alexander Mackenzie, 1792-3. It was from this fort that he started on his perilous and historic journey to the Pacific."

In addition to the above the board recommended that the public services of the following outstanding personages in Canadian history be suitably commemorated:

"Three Rivers, Quebec — Benjamin Sulte, outstanding historian and poet. Born, Three Rivers, September, 1841; died, Ottawa, August, 1923.

"Annapolis Royal, N. S.—Samuel Vetch, Adjutant General of the force which captured Port Royal, 1710. First Governor and Commander-in-Chief.

"Toronto, Ontario — Sir Gordon Drummond, a successful and talented military commander, who served with distinction in the War of 1812, and who administered the civil affairs of Upper and Lower Canada at critical times."

Reading Considers Water Works Loan

Instead of floating a bond issue to pay the municipal improvements, consideration is being given to a plan for mortgaging the city's water works to raise money, according to a statement made recently by Mayor J. Henry Stump, of Reading, Pa.

"City Solicitor John G. Rothermel has investigated the matter," declared Mayor Stump, "and has found it to be perfectly legal. We plan to borrow $1,500,000. The assets of the works are figured at $12,000,000. The money raised by this mortgage would be used to pay for the condemned land in the Maiden Creek Impounding Dam area and for improvements to Hampden Reservoir."

Mayor Stump emphasized the fact that by mortgaging the water works no increase in water rates would follow.

Force Account on Unit-Price Construction Contracts

Philadelphia Bureau of Municipal Research Presents Valuable Study

The late Thomas Skelton Harrison of Philadelphia gave the residue of his estate to a board of trustees to be used "generally for such purposes as will contribute toward improvement of governmental conditions in the city of Philadelphia." These trustees organized the Thomas Skelton Harrison Foundation to administer these funds.

Among the special purposes mentioned in Mr. Harrison's will is the obtaining and dissemination of information about municipal affairs in Philadelphia. That Mr. Harrison also had a special interest in city contracts is indicated by the authority given to the trustees in other parts of the will to use the fund to secure the impartial enforcement of such contracts.

It therefore seemed to the trustees to be especially fitting and in line with Mr. Harrison's wishes that a study be made of the methods followed in Philadelphia in the preparation, letting, and performance of contracts for municipal work. The Bureau of Municipal Research was engaged to make such a study as the Foundation's agent and at its expense.

The following report, "Force Account on Unit-Price Construction Contracts," deals with one of the subjects to which the Bureau has given attention in the course of the study. This very interesting report, prepared by their Civil Engineer, Mr. Phillip A. Beatty, is abstracted extensively in the following pages for the benefit of municipal authorities throughout the country.

THE purpose of this report is to discuss methods of handling force account on unit-price contracts for public works in Philadelphia. Philadelphia's practices are analyzed and compared with practices in other cities. The report ends with a summary of conclusions and recommendations for Philadelphia.

Prior to the analysis of particular force-account practices, the report defines "unit-price contract" and discusses the problem presented under such contracts by work which is part of the project contracted for, but which is not foreseen when the contract is let, and which is not covered by the price bid. "Force account" is then defined and shown to be one of the methods of performing and paying for extra work.

Sources of Information.—In order to discover the best practices and to provide fair standards by which Philadelphia's practices might be measured, the Bureau of Municipal Research has examined the specifications of 31 public authorities responsible for letting contracts for public works, who make provision for force account.

The Standard Municipal Contract Form, published by the American Society for Municipal Improvements, has also been examined.

In addition to the specifications that were studied, opinions have been obtained from about 20 experienced engineers and contractors in various parts of the country.

Extra Work.—The mayor and council, assisted by the engineers of the city department having jurisdiction, and possibly by consulting engineers not connected with the city administration, having decided upon the necessity, the location and the financing of a project, the engineers begin the work immediately precedent to advertising for bids. The site is explored with test pits and borings to find rock or other material upon which the structure may be founded, and to ascertain the quantity and kind of material which must be excavated. This information is a determining factor in the selection of the type and the extent of the foundation structure. The plans are drawn and an estimate of quantities is made from which a schedule of items and quantities is prepared, and specifications written.

Plans Drawn. — Plans supplemented by the specifications, together with the schedule of items and quantities, are prepared to show the bidder what will be required of him. The plans, specifications, schedule, and agreement combine to form one instrument under which the work is to be done. Attached to the specifications, and forming a part thereof, is the schedule of items and quantities.

The general practice is for the contractor, in making his bid, to indicate on this schedule the unit prices for which he will do the work. These unit prices, multiplied by the number of units, give the "extensions." The sum of the extensions is the "bid price." The bid prices are compared and from them the "lowest responsible bidder" is selected.

Added Work.—If the schedule indicated every item and the total quantities with absolute accuracy, and if the plans and specifications were perfect, there would be no necessity for extra work; and, if all went well with the contractor, the contract could be completed at the price bid. This probably never occurs on major work. During construction it may be to the city's advantage to make extensive alterations in the plans, or unforeseen conditions may arise to upset preliminary calculations. Since these contingencies cannot always be foreseen, the price bid by the contractor does not provide for the added costs. Hence, when the added work is done, the contractor feels justified in claiming additional compensation.

How shall the additional compensation be fixed? The problem is simplest when the added work is comparatively small in amount, and of a kind for which a unit price has been bid. Most specifications reserve to the engineer the right to increase or decrease the itemized quantities after the letting of the contract, paying for the work actually done at the unit price bid. No limit is placed upon the increase or decrease by the Philadelphia specifications, but such limits are found in some contracts for public work. The department of public works of Baltimore, for example, restricts the change to "less than 20 per cent of the total amount of the contract price."

This report is not especially concerned with additional work. It is rather concerned with "extra work," which may be defined as (1) work of a kind for which unit prices have been bid, but in excess of the quantity which the contractor is obliged to do at the unit prices, or (2) work of a kind for which no provision at all has been made in the schedule. Compensation for extra work may be fixed by a supplementary contract or under an extra-work clause in the contract. The latter is generally used.

Extra Work.—There are several methods by which the contract may provide for payment for extra work. These are:

1. At the unit prices bid by the contractor.
2. At fixed prices stated in the specifications.
3. Under a special unit-price agreement between the contracting parties.
4. With a lump sum, agreed upon between the engineer and the contractor.
5. By force account, on a cost-plus-a-percentage basis.

6. At cost plus a fixed sum.

Which of these is preferable depends upon the particular circumstances. Each method may have advantages and disadvantages.

The first method, of course, can be used only where the extra work is of a kind covered by the unit prices. If it can be used it is usually the best method.

Fixing the prices in the specifications, the second method, gives the contractor no choice concerning them, and is open to the objection that the prices fixed may be lower than the price for which the contractor thinks he can do the work. In that event he must be willing to accept a loss, refuse to bid, or add something to another item to make up a possible shortage. As the specifications give only the fixed prices for the extra work, and not the quantities, a definite conclusion as to additional costs cannot be reached by the contractor and he must add what he hopes will be enough to cover them. On the other hand, if he considers the fixed prices high enough to yield a good profit, he is debarred from reflecting this thought in his estimate, because it may happen that no extra work will be done under these prices.

A special unit-price agreement for extra work, the third method, has much to recommend it, if approached in a fair, open-minded manner by two experienced men. However, the contractor is usually better equipped than the engineer for this bargaining, since he is in daily touch with costs, while the engineer has them only at second hand.

The fourth method is the "lump-sum" agreement. As compared with other methods, this one seems to have no special advantages. If it is used, there are only two ways to arrive at the lump sum. One is an "intuitive estimate"—that is, a guess; the other, a knowledge of unit prices and quantities. Some intuitive estimaters are good guessers, and some are not. This makes the results uncertain. On the other hand, if the unit prices and quantities are known, the first or the third method would seem preferable.

Force Account.—"Force account," the fifth method of paying for extra work, places the contractor's forces, or a portion of them, at the disposal of the employer's engineers. Separate accounts are kept of the cost of these forces and of the materials incorporated by them in the structures, and these costs, plus a percentage of them previously agreed upon, are paid to the contractor. The percentage is intended to cover overhead, general supervision, and other items set forth in the specifications. Force account, then, is a term used in this report to designate work which is done under the contract, though not included in the contractor's bid, and which is paid for at cost plus a percentage. Although this report deals especially with force account as a means of performing and paying for work which is not foreseen at the time a unit-price contract is let, it should be understood that force account may be a method of performing and paying for the entire job.

The sixth method is cost plus a fixed sum. This method is listed in the Standard Municipal Contract Form issued by the American Society for Municipal Improvements. It is similar to force account except that the contractor receives a fixed sum in addition to the cost of the work instead of cost plus a percentage of the cost. The intent is to remove any incentive to increase the cost of the work which may exist if a percentage of the cost is paid.

Philadelphia Methods.—The departments of public work, city transit, and wharves, docks, and ferries let most of the contracts for public works in Philadelphia. Their methods of paying for extra work differ.

The department of wharves, docks, and ferries does not use force account. When the necessity arises of doing unforeseen work, a special agreement is entered into with the contractor.

In the department of public works the specifications of the bureaus of highways and engineering require the contractor to accept for any extra work which may be ordered by the engineer (1) the unit prices bid, and (2) the fixed prices for contingent work given in the specifications. Should neither of these methods apply the work is to be done at a price agreed upon in writing by the contractor and the engineer, and approved by the director. The extra-work provisions of the specifications of the bureau of highways end here, but those of the bureau of engineering go one step further, providing for force account if the other methods are impracticable.

Specifications of the department of city transit provide "for such additional work . . . at the unit prices bid where applicable, or, when the unit prices do not apply, at the discretion of the director, either at a price agreed upon in writing by the director and the contractor or under force account."

In Philadelphia, therefore, force account is a method of paying for extra work in the bureau of engineering (department of public works), and in the department of city transit. In these units it is a method provided for use in the event that other methods fail. Because of its adaptability to all situations, its flexibility and elasticity, force account is a useful alternative of the other methods. The other methods have their disadvantages, and those which depend upon agreement between the contractor and the engineer may be impracticable because of the impossibility of reaching an agreement. It is desirable, therefore, to be able to fall back upon force account when other methods fail.

In the 30 specifications examined, exclusive of Philadelphia's, the force-account method of paying for extra wo is first choice with eight, second choi with thirteen, third choice with seve and fourth choice with two. Fourte make the unit prices bid by the co tractor their first choice; one u s fixed prices in the specifications as its first choice; five choose first the spe al unit-price agreement, and one the lu p-sum method. By using force acco nt only where other methods are impr cticable, Philadelphia's practice conforms, therefore, to the practice as shown by the majority of specifications studied.

Force-Account Practices.—While the force-account method has advantages, it must be kept under rigid control, and must not be too attractive. Otherwise the advantages of elasticity and flexibility become disadvantages.

Force account is subject to abuse. The inexperienced engineer may take the easier method of using force account for work which is quite susceptible of classification and appraisal. In so doing he will increase the need of field supervision, render costs uncertain, and open the way for undue expansion of this class of work. And the contractor may endeavor to expand the volume of work to be done on a force-account basis if it affords him an attractive profit.

Reference has already been made to an examination of the specifications of a number of cities which use force account. The rest of this report is devoted to a statement of the more important force-account practices observed in the specifications studied, and a comparison of these practices with those used in Philadelphia.

Fixing the Percentage.—It is an almost universal custom with engineers to state in the specifications what percentage of direct cost will be allowed for force-account work. In Philadelphia the bureau of engineering has been using this method. The department of city transit has used the method on some contracts, but on others (North Broad Street subway contracts No. 101, 102, 110, 107A, and 107B, for examples) the contractor was required to bid the percentage. The percentage bid by the contractor worked into the contract price as follows: An estimated amount of force-account work was named in the specifications. Application of the percentage bid by the contractor to this estimate resulted in a figure which was added to the amounts bid on unit-price work and the total thus arrived at was the contractor's bid, used in comparison with other bids to decide which was the lowest.

The practice was illogical because the estimated amount of force-account work was entirely speculative. If it had not been, the work could have been included in the schedule of unit prices. Force-account work is, or should be, unforeseen or emergency work. Hence any estimate of it in advance introduces a fictitious item into the bidding.

Obviously this method gave little assurance that the city would find the best bidder. It might easily happen that the contractor submitting the lowest bid for the job originally would be the most expensive in the end because of a high percentage on an amount of force account much larger than was anticipated. "Bidding the percentage" on force account therefore opens the way for an "unbalanced bid." A contractor may have special familiarity with local conditions which enables him to foresee that more force-account work will be required than was estimated by the city's engineers. He can bid a high percentage on force account and a low unit price on another item, thus keeping down the bid which is to be compared with other bids, but relying on a neat profit on the increased expenditure for force account. The practice would tend to place out-of-town contractors at a disadvantage, because the local contractors, having superior knowledge of the conditions, would be able to approximate more closely the actual amount of force-account work needed.

In the course of this study it has not been discovered that the practice of estimating the amount of force-account work and requiring the contractor to "bid his percentage" has been used anywhere but in Philadelphia. There seems to be no good reason for perpetuating this unusual custom, and very good reasons for abandoning it. The department of city transit has evidently been fully alive to the objections to the practice, which was introduced in its earlier days, and has been emancipating itself from it in its minor contracts. It recently cast it overboard altogether on a major contract, having specified 15 per cent on the costs of labor, materials, and liability insurance in its South Broad Street subway specifications.

Percentage Provisions.—The specifications of the bureau of engineering dealing with force account provide that—

(a) For all labor, teams and foremen in direct charge of the specific operation, the contractor shall receive the current local rate of wage, to be agreed upon in writing before starting such work, for each and every hour that said labor, teams and foremen are actually engaged in such work, to which shall be added an amount equal to fifteen per centum of the sum thereof.

(b) For all materials used the contractor shall receive the "actual cost" of such materials, including transportation charges, as shown by original receipted bills, to which cost shall be added an amount equal to ten per centum of the sum thereof.

(c) For machinery, power tools or equipment, including fuel, lubricants, operating tools, repairs and replacements which it may be . . . necessary or desirable to use, the engineer shall allow the contractor a reasonable rental price, to be agreed upon in writing before such work is begun, for each and every hour that such tools or equipment are in use on such work, and to which no percentage shall be added.

Current specifications of the department of city transit, as they appear in contract 109 for the South Broad Street subway, provide that "payment under force account will be made on the actual net direct expenditure for material, labor, and employer's liability insurance, plus 15 per cent."

Variations as observed in the specifications just quoted are common to all the specifications examined. No effort has been made to standardize these items, although it seems that there would be advantage in so doing. From the following, however, it will be seen that Philadelphia's practice is not abnormal in respect to the costs upon which a percentage is allowed.

In the 30 specifications of other cities embraced in this study, cost plus a percentage is paid on labor. Twenty-six pay cost plus a percentage on materials; four pay cost only.

On plant rental, six pay a percentage; twelve pay rental without a percentage, while six pay no rental, but include plant costs in the percentage. Six do not touch upon the subject. Further consideration is given to plant rental in a subsequent section of this memorandum.

A percentage is given on the cost of insurance on labor by seven. Eleven pay insurance cost only. In eight, the insurance is to be included in the percentage, while four do not refer to insurance. It is noteworthy that, although the department of city transit allows employer's liability insurance, plus 15 per cent, the specifications of the bureau of engineering do not mention insurance either as an item of cost to be allowed with or without a percentage or as something for which the percentage compensates the contractor.

What Percentage Pays for.—Generally speaking, of course, the percentage is intended to compensate the contractor for the items of cost which are not specified as being chargeable to the city, together with a profit. If, for example, insurance costs cannot be charged to the city, the percentage on items which can be charged must be supposed to compensate the contractor for it. However, specifications usually name some or all of the items which the percentage is to cover. Thus, in the specifications of the Baltimore city water department, it is provided that the "actual cost" of force-account work "shall not include the use of tools nor general superintendence, nor office accounting or engineering expenses, nor any allowance or percentage for collateral or estimated costs, nor any profit," all of which is deemed to be included in the specified 15 per cent allowance.

The Salt Lake City paving specifications provide "20 per cent for supervision, overhead, insurance, profit, etc.," while the New York board of water supply in the Gilboa dam specifications requires that "10 per cent shall be considered as covering administration, general superintendence, profit, and all other expenses not included in the net cost."

Pittsburgh's general construction specifications provide that no "interest, rent, depreciation of plant, service of general superintendent, or administration force" shall be included, the allowance of 15 per cent including all such expenses, profits, and contingencies. In Milwaukee, the 15 per cent covers "administration and clerical expenses, supervision and superintendence above foreman; . . . cost, use or upkeep of tools, plant and machinery and rent of storage yard."

Philadelphia specifications are much the same as the foregoing. The compensation allowed by the bureau of engineering is to be accepted by the contractor as full payment for additional work done on a force-account basis, and "shall include superintendence, use of hand tools and equipment necessary to the work for which no rental is allowed, and profit on the work." In the department of city transit the percentage is to compensate the contractor for "superintendence, the furnishing and use of tools, plant and equipment, overhead and profit."

It is believed that the bureau of engineering should allow workmen's compensation insurance as an item of cost chargeable to the city. Whether a percentage should be allowed on it in addition may be left an open question. To allow the insurance, plus 15 per cent, would bring the practice of the bureau of engineering into conformity with that of the department of city transit.

The premium on the surety bond covering the contract is not mentioned in Philadelphia specifications, either as an item of cost to be allowed or as an item for which the percentage compensates the contractor. This practice seems justifiable, provided the contractor does not have to pay an additional surety bond premium for the force-account work. If the force-account work involves an additional premium for the contractor, he should be allowed to charge it to the city. Similar considerations would apply to the penal bond.

What Percentage?—It has been seen that the department of city transit pays a straight 15 per cent, while the bureau of engineering pays 15 per cent on labor and 10 per cent on materials.

Richmond, Virginia, pays a straight 12 per cent. On the Gilboa dam, 10 per cent is paid. Saginaw and Flint, Michigan, Salt Lake City, and Santa Fe, pay 15 per cent on labor and 10 per cent on materials. San Francisco pays 10 per cent on the cost of materials going into the work, premiums for workmen's compensation insurance, and the cost of labor, including foremen, with an additional 10 per cent on the cost of labor and its percentage. All the other specifications studied allow a straight 15 per cent.

Rental of Plant.—As previously stated, some specifications provide for rental of plant and equipment with a percentage, some for rental without a percentage, some for compensation for the plant out of the percentage on other items, and some do not mention plant rental.

If machinery or power tools, teams and horse-drawn equipment are re-

quired, they should be employed on an hourly rental basis. The rental should include power, fuel, lubricants, and maintenance. If repairs and replacements are allowed, the plant should be carefully inspected before being put to work and a record made of its condition. It simplifies bookkeeping to include machine operators and drivers in the hourly rental price. It appears best to include a profit in the rental price.

The specifications of the bureau of engineering provide a reasonable rental, without percentage, for machinery, power tools, or equipment. This seems the best practice. The specifications of the department of city transit are less satisfactory. They make no provision for rental of contractor's plant and equipment in force-account work, this being included in the percentage.

Repairs to Plant.—The subject of repairs to the plant used on force-account work is referred to in but few of the specifications coming within the scope of this study. It is a matter upon which opinion seems to be divided. Of the specifications referring to it, some allow repairs and others state that no allowance will be made. If repairs (as distinct from maintenance) are not allowed, it would seem only good business on the part of the contractor to add something to plant rental to cover breakage or damage incurred exclusively on this work. If repairs are allowed, there is an opportunity for an unscrupulous contractor to charge for repairs properly chargeable to other jobs. A definite clause covering this matter would, however, prevent uncertainty as to the city's stand, and the elimination of uncertainty at every possible point should be the aim of every engineer. In Philadelphia, the bureau of engineering seems to be the only one touching upon this point in its specifications, the cost of repairs and replacements being included in the rental price.

City Materials.—Should the municipality be able to purchase cement or cast-iron pipe or other construction material at a price lower than can be obtained by contractors, it will probably be to its advantage to furnish these to the contractor. This right is reserved in various specifications, usually with the additional provision that no percentage shall be paid upon the material so furnished.

It seems desirable for the city to reserve the right to furnish the material. Whether a percentage should be allowed on it should, perhaps, be considered an open question.

Part of the Contract.—The specifications should make it clear that extra work, including force account, is an integral part of the job covered by the contract and subject to all the conditions thereof, thus directing the contractor's attention to his acceptance of all regulations controlling the subletting, abandonment, neglect, or unreasonable delay of work; carelessness or bad faith; materials, workmen and workmanship; superintendence, payments, suits, claims, and the responsibility for accidents leading to loss of life or destruction of property.

All forces engaged on force-account work should be as fully insured as on unit-price work. When the amount of force-account work is small, forces are usually simply transferred from the unit-price work. Whether transferred or specially employed, they should be fully covered by workmen's compensation insurance.

Not only should specifications include as part of the contract all extra work properly belonging to it, but they should also make it clear that extra work which does not properly belong to it is not to be charged to it. Charging one contract with extra work which belongs to another is a possibility when the contracts are adjacent. The provision in the specifications of the bureau of engineering that the contractor shall "do such additional work . . . as may be necessary . . . to fully complete the work as planned and contemplated," is probably adequate to exclude work not a part of the job.

Limiting the Amount.—In the specifications of some cities the amount of force-account work is restricted. The board of transportation of New York City limits the total amount which may be paid on force account for work and materials to 2 per cent of the total contract price, and no expenditure in excess of $50,000 is binding upon the city until approved by the board of estimate and apportionment. Under the Gilboa dam contract of the board of water supply of New York City, not more than 5 per cent of the estimated amount of the contract price may be spent on force-account work. New Orleans restricts the amount which may be spent in this manner on her paving contracts to $500.

No other city coming within the scope of this study, including Philadelphia, makes such restrictions. They are, however, strictly in accord with the thought of placing force-account work under reasonable control, and on large contracts they seem especially desirable.

On small contracts it might be sufficient to provide in the specifications a limit upon force account beyond which it would be unlawful to go without approval of the director of the department. This would be effective as a device for making it certain that the extent of the force-account work came to the attention of the department head. Limits upon the power of the department to have work done on force account would, of course, have to be imposed by an authority higher than the department. They could be imposed by the city council.

When the amount of extra work is very large, it should be done by a method other than force account—preferably under a separate contract in which all the elements have been discussed and reduced to writing.

Written Order Required.—Specifications ordinarily stipulate that no work shall be paid for except upon a written order signed by a designated official, usually the chief engineer or his accredited representative. Frequently a counter signature is required, as that of the director, the commissioner, or other official. This tends to preclude any possible ambiguity or misunderstanding about the amount or kind of work to be done. A written order is more likely than an oral one to express clearly the requirements and limitations of the work to be done, a thing always desirable when the expenditure of money is involved.

The engineer, however, should have the authority to issue and the contractor to receive oral authorization for extra work in case of emergency, to be confirmed by the written order within 24 hours.

In Philadelphia the specifications of the department of city transit for the South Broad Street subway provide that "no work nor material will be paid for under force account unless it be ordered as such in writing by the chief engineer." The specifications of the bureau of engineering, for main and branch sewers, provide that "the engineer, with the approval of the director, may order such work done on a force-account basis" and that prices are to be agreed upon in writing, but there is no provision requiring written authority for beginning force-account work.

Written Agreement on Costs.—An oral agreement, or one evidenced by an informal memorandum made by an engineer in the field, to pay the contractor the current local rate of wage for labor or a rental for machinery in manifestly a rather loose method, particularly when large amounts of labor or machinery are involved. The specifications of the bureau of highways, department of public works, Baltimore, Md., are more precise. They provide that:

For all labor, teams, trucks, and foremen in direct charge of the specific operation, the contractor shall receive the current local rate of wage, to be agreed upon in writing before starting such work.

For any machine power tools or equipment, including fuel and lubricants, which it may be deemed necessary or desirable to use, the engineer shall allow the contractor a reasonable rental price, to be agreed upon in writing before such work is begun.

In Philadelphia the specifications of the bureau of engineering, department of public works, require a written agreement on rates for labor, teams, and foremen before force-account work is begun. The specifications of the department of city transit require costs to be approved by the engineer, but do not state that they must be approved before the work begins.

There are other phases of the question covered in the report, but space does not permit more than mention of the fact that special time sheets are advisable on a job to show labor on force account, that it is well to make payments on force-account work at the same time as payments are made on contract, having the contractor present itemized bills monthly in time for the monthly estimate and that several specimen contracts provide for extensions of time in case of unavoidable delays on the work.

Summary.—The Bureau of Municipal Research submited the following summary of conclusions and recommendations, based upon the analysis of methods of paying for extra work, particularly the force-account method, made in the report:

1. The specifications should be truly specific and should be standardized as far as practicable. Every point which, so far as can be foreseen, may raise a question between the contractor and the engineer during performance of the contract, or in the mind of the contractor at the time of making his proposal, should be covered in the specifications. Standardization of specifications—that is, uniformity with other cities—is, of course, not a matter solely within the city's control. However, officials should take advantage of every opportunity to promote uniform specifications. Completeness and uniformity of specifications should encourage bidding, especially by out-of-town contractors, by reducing the necessity of guarding against surprises which may otherwise be encountered during the course of the work.

2. Extra work probably cannot be avoided on major constructions, and provision should be made for it in the specifications.

3. A schedule of fixed prices for extra work is of doubtful utility for the reason that if the kind, quantity, and cost of the work (all of which must be known in order to fix prices intelligently) can be foreseen, it would be better to provide for the extra work in the schedule of items and unit prices; and if they cannot be foreseen, any figures prepared by the engineers must be guesswork, which is contrary to the whole theory and intent of the specifications.

4. It would seem best to use force account only where other methods of paying for extra work are impracticable. Other methods should, therefore, be provided for in the specifications; but force account should also be provided for in the event that the other methods are found impracticable.

5. The percentage to be allowed on force-account work should be fixed at a reasonable rate stated in the specifications.

6. The items on which the percentage is allowed and the items for which the percentage is meant to compensate the contractor should be stated in the specifications.

7. The specifications should provide for the rental of plant, equipment, and power tools at prices to be agreed upon in writing, and should state how plant repairs are to be taken care of. No percentage should be allowed on rental.

8. Extra work should be expressly made a part of the contract, subject to all the conditions of it, especially those referring to insurance, and the fixing of responsibility for accident.

9. On large contracts the amount which can be spent on extra work should be limited to some percentage of the contract price and a sum should be set beyond which payment for extra work cannot be made without additional authorization.

10. It may be desirable at times for the city to furnish materials for construction. The specifications should therefore reserve this right.

11. Except for work done in emergencies, claims for force-account work should not be valid unless based on written orders, and costs should be agreed upon in writing before work is begun.

12. Specifications should provide for daily checking of time sheets by representatives of the contractor and the engineer and for the filing of the sheets in their respective offices.

13. Payments for extra work should be made monthly and should be based on monthly statements made by the contractor.

14. Specifications should give the contractor the right to an extension of time for the completion of a contract delayed by the necessity of doing extra work.

Municipal Airport Construction

The following figures from June Concrete Highways and Public Improvements shows the municipal airport developments in a number of representative cities:

Baltimore—Pop. 819,000—bond issue passed in 1927, $1,500,000.

Buffalo—Pop. 550,000—expenditures to date $1,000,000.

Cleveland—Pop. 984,500—bond issue approved $1,250,000.

Dallas—Pop. 211,600—bond issue approved in 1927 $400,000.

Dayton—Pop. 180,700 bond issue for improvements $250,000.

Lincoln, Neb.—Pop. 62,000—passed bond issue $100,000.

Newark—Pop. 466,700—for immediate construction $1,250,000. Complete development will be $6,000,000.

New York—Pop. 5,970,800—site approved, Feb. 1928. Appropriation for preliminary work $500,000.

Oakland, Cal.—Pop. 267,300—expenditure during 1927 $1,000,000.

Portland, Me.—Pop. 76,400—1927 expenditure $100,000.

Portland, Ore.—Pop. 258,288—expenditure reported $1,250,000.

San Diego—Pop. 115,300—bonds approved Nov. 1927 $650,000. Additional plans for municipal and naval use $1,156,000.

Seattle—Pop. 375,300—expenditures to date $125,000. Development calls for $2,000,000.

San Francisco—Pop. 576,000—for preliminary work $1,000,000.

St. Paul—Pop. 250,100—preliminary work $250,000.

Sewage Research Laboratory Established at Texas College

The Engineering Experiment Station of the Agricultural and Mechanical College of Texas, College Station, Texas, has recently established a laboratory for sewage research. The work planned will include studies of sludge digestion, utilization of sludge, action of filter beds and stream pollution. Special attention will be given to problems peculiar to Texas and the Southwest. Extensive remodeling of the two sewage disposal plants of the college has been done to aid the research work.

The work will be under the general supervision of Dr. F. E. Giesecke, Director of the Engineering Experiment Station. E. W. Steel, Professor of Municipal and Sanitary Engineering, will direct the investigations. P. J. A. Zeller, formerly chemist with the New Jersey Sewage Experiment Station, has been appointed Research Associate. The personnel of the Agricultural Experiment Station, which is also located at the A. and M. College, will cooperate in the studies of use of sludge as a fertilizer.

Rear Yard Requirements for Dwellings and Apartment Houses of Cities Having Housing Codes
Compiled by Jessie May Short of Reed College, Portland, Ore.
Minimum Requirement in Feet, Based on 50x100-Ft. Lot

Name of City	Corner Lot—Number of Stories						Interior Lot—Number of Stories					
	1	2	3	4	5	6	1	2	3	4	5	6
Berkeley	10	10	10	15	20	25	10	10	10	15	20	25
California	10	10	10	10	10	10	10	10	10	11	12	13
Columbus	15	15	15	15	15	15	18	18	18	18	18	18
Detroit	10	12	14	16	20	24	10	12	14	16	20	24
Duluth	12	14	16	18	20	22	12	16	16	18	20	22
Indiana	15	15	15	18	21	24	25	25	25	28	31	34
Iowa	10	12	14	16	18	20	10	12	14	16	18	20
Louisville	12	13	14	15	16	17	12	13	14	15	16	17
Michigan	10	12	14	16	20	24	10	12	14	16	20	24
Massachusetts	15	15	15	20	25	30	25	25	25	30	35	40
Minneapolis	15	15	20	25	30	35	15	15	20	25	30	35
Minnesota	20	20	22.5	26.5	29.5	31.5	20	20	22.5	26.5	29.5	31.5
Sioux City	10	12	14	16	18	20	10	12	14	16	18	20
Average	12.6	13.5	14.8	17.3	20.2	23.0	14.4	15.2	16.7	19.3	22.1	24.9

Methods of Water Treatment at Chain of Rocks and Harvard Bend Plants, St. Louis

A Paper Presented Jan. 24 at Texas Water Works Short School

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THE present water supply is obtained from the Mississippi River at the Chain of Rocks—about ten miles north of the center of St. Louis. The river water enters our plant through two intakes, one, the old or west intake, 1,500 ft. east of the west bank of the river and connected to the wet well by a 7-ft. circular, brick-lined tunnel, 2,197 ft. long. The other or east intake is 700 ft. east and 200 ft. north of the west intake and is connected to the wet well by an 8-ft. circular, concrete-lined tunnel, 2,747 ft. long.

The water entering the tunnels flows by gravity to the wet well, whence it is pumped, against a dynamic head of 58.3 ft. into the delivery well, and flows from there to the grit chamber where the average velocity of flow, at a rate of pumping of 150,000,000 gal. per day, is only 0.33 ft. per second, the retention period being 7.5 minutes.

In this chamber the coarser and heavier part of the suspended matter is deposited, the amount removed depending upon the character of the suspended matter as well as upon the amount present in the water. The coefficient of fineness of the suspended matter during the past ten years has varied from 0.98 to 1.56 and the amount of suspended matter removed by the grit chamber has varied from 9.0 to 32.0 per cent.

Application of Chemicals.—Leaving the grit chamber, the water flows through a short conduit to the mixing conduit, where milk of lime and a solution of sulphate of iron are added. These chemicals are prepared in the coagulant house for addition to the water and are pumped 900 ft. to the mixing conduit.

The lime is weighed out in automatic scales and is dumped into circular slaking tanks which are provided with revolving rakes. The temperature of the milk of lime is maintained at 200 deg. F. The hot milk of lime overflows the slaking tank into a heater tank and passes through a number of boiler tubes around which circulates the water that is used in slaking. In this way the temperature of the slaking water is increased 30 deg. to 50 deg. F., and the heat produced by the slaking of the lime is sufficient to maintain the milk of lime in the slaking tank at 200 deg. F. From 4 to 4½ lb. of water per lb. of lime are used in slaking. The milk of lime from the heater tank is run into a cooling and diluting box, where the temperature is reduced to as low as 64 deg. in winter, to 180 deg. in sumder. The strength of the milk of lime as pumped is 38,600 parts per million of calcium oxide.

The Mixing Conduit.—The mixing conduit into which the chemicals are delivered is a reinforced concrete box, 2,382 ft. long, 32 ft. 1 in. wide and 12 ft. 6 in. high, divided longitudinally into four compartments, each 7 ft. wide and 11 ft. high. The four compartments are supplied with stop-plank openings so that they be used in parallel, series or withdrawn from service for cleaning.

In normal operation the water enters the two west channels and travels the full length two times, a total of 4,764 ft., having an average velocity of 1.65 ft. per second when the rate of pumping is 150,000,000 gal. a day. Provision is made so that the lime or iron may be added to either of the four compartments, but the lime is added, for the greater part of the time, to the raw water as it enters the mixing conduit and the sulphate of iron as it leaves the conduit. The period of mixing averages about one hour.

The Coagulation Basins.—After passing through the mixing conduit, the water enters the first of six coagulation basins, each 400 ft. long by 670 ft. wide, of 30,000,000 gal. capacity. The first three division walls have five stop-plank openings, and the last two, four openings, all 4½ ft. deep by 8 ft. long. These openings render the coagulation basins less efficient than would weirs extending the full width of the basins, but because of the necessity of maintaining an elevation of water but little lower than the top of the basins, the need of stop-plank openings at times of cleaning is apparent. The time of sedimentation, based upon the capacity of the basins, varies from 30 to 43 hours, but the actual time is much less, the effects of a change in the amounts of chemicals added being noticeable in 12 to 15 hours in the last of the basins. About 90 per cent of the suspended matter and bacteria are removed in the first basin and 9 per cent in the remaining basins.

Removal of Mud.—The total amount of matter removed from the water during the past year, including the chemicals added and the dissolved solids removed, amounted to 270,861 tons. Some of the mud was removed by opening the sewer gate for one-half hour at varying intervals, but the greater part was removed from the basins by labor and tractors. The tractors are equipped with bulldozers which cut off portions of the mass of mud and push them to the central gutter, through which water is flowing. The men are provided with scrapers which are used to remove the mud from the sloping sides of the basins and to clean up after the tractors. The cost of the removal of the mud from the sedimentation basins, including the cost of the water, was 5.0 ct. per cu. yd. for the past year, 1.74 ct. for labor and 3.26 ct. for water.

Secondary Coagulation Basin.—The water leaving the coagulation basins enters a collecting conduit and passes through two 8-ft. Venturi meters and into a small secondary coagulation basin, connected to two larger coagulation basins by stop-plank openings. The solution of sulphate of alumina is added at the throat of the meters and is automatically controlled so that the quantity added per unit is constant for any setting, regardless of fluctuations in the flow through the meters.

No mixing chamber is provided here because of the low permissible loss of head, namely 1½ ft. There are two secondary coagulation basins, one east of the filter plant and one north, each of which is connected to the influent flume of the filters. The time of reaction and sedimentation, based on capacity, is twelve hours with both basins in service and six hours with one. The water entering the secondary coagulation basin has a turbidity less than 25 parts per million as an average.

Secondary coagulation has been practiced at this plant since the filters were put into service in 1915. When a turbid water is treated with enough lime to produce considerable softening and sulphate of iron is used as a coagulant, it will be found that when the water is clear enough to be placed on the filters, that no floc is left in suspension. It is necessary to provide a floc by adding a secondary dose of coagulation if successful operation of the filters is desired. Aluminum sulphate is used as the secondary coagulant and decided reduction in the normal carbonate alkalinity results.

The reduction in total alkalinity from the use of 1.41 gr. per gal. was 13

p.p.m. and the normal carbonate alkalinity was reduced from 48 to 17 p.p.m. This action of aluminum sulphate also prompted the use of a secondary coagulant. The value of secondary coagulation may be seen by a study of the results shown in our annual reports.

The Filter.—The water entering the filter plant is passed through 49 filters, each with a filtering area of 1,400 sq. ft., or 4,000,000 gal. capacity. The filtering media consist of 30 in. of sand above 12 in. of graded gravel. The effective size of the filter sand as placed in the filters was 0.341 mm., with a uniformity coefficient of 1.81. The effective size has increased to 0.45 due to the coating on the sand grains as a result of the use of lime for softening.

Chlorination. — For the past two months chlorine has been added to the settled water entering the secondary coagulation basins. Enough is added to maintain a slight amount of free chlorine in the water passing on to the filters. A decided reduction in the number of bacteria results from the treatment and thus an added factor of safety is provided by rendering the effluent from the filters safe for consumption without the use of extra chlorine, although chlorine is added to the effluent to maintain 0.2 p.p.m. residual chlorine five minutes after the final dose. The total amount of chlorine necessary to maintain the desired residual is but slightly greater than if the entire amount were added to the effluent.

Howard Bend Plant.—The new water works is located about 17 miles west of the St. Louis Court House on the Missouri River. The water will enter a shore intake through any of 15 gates, pass into five chambers, each chamber having three gates. The chambers are so connected that the water entering any gate may be drawn into any chamber, each chamber being equipped with a traveling screen to prevent the entrance of debris into the pumps.

The Low Service pumps will deliver the water into two primary clarifiers, each 150 ft. square with a working capacity of 2,500,000 gal. The water will enter each unit through five 2-ft. x 3-ft. gates, spaced 30 ft. on centers into a stilling box 3½ ft. wide and then through 100 2-in. x 8-ft. 6-in. slotted openings spaced 1 ft. 6 in. on centers. The water will be drawn from the basins through similar slotted openings, into a stilling box and then through the gates. The velocity through the clarifier will be 1.2 ft. per minute and the detention period 2 hr. 10 min. at 55 m.g.d. Although the raw water entering these clarifiers will sometimes be as great as 10,000 parts per million, it is expected that the effluent from the clarifiers will rarely exceed 500 p.p.m.

Mixing Conduit and Tanks. — The water leaving the primary clarifiers will pass into a primary rapid mixing conduit made up of sections, 10 ft. high by 5 ft. 6 in. in width, five 180 deg. and one 90 deg. rounded turns being provided. The full length flow through the conduit will be 170 ft. The velocity at 55 m.g.d., will be 1.55 ft. per second and the detention period 1 minute 50 seconds. The milk of lime prepared in the coagulant house will be added as the water enters the conduit and the sulphate of iron as it leaves.

The water will pass from the mixing conduit into two circular mixing tanks, each 65 ft. in diameter with a working capacity of 292,000 gal. The water will be introduced tangentially at the top and be taken off at the center bottom. Each unit is designed for a maximum capacity of 16 m.g.d. and at this rate the mean velocity will be about 0.6 ft. per second and the detention period will be 26 minutes. The entrance velocity may be increased by decreasing the size of the entrance conduit.

Secondary Clarifiers and Coagulation Basins.—From the circular or tangential mixing tanks, the water will go to the secondary clarifiers. The velocity and detention in these clarifiers will be the same as in the primary. It is expected that the water leaving these clarifiers will usually have a turbidity of less than 200 parts per million, the amount of sulphate of iron calculated to produce this effluent being 3-8 grain per gallon.

After leaving the secondary clarifiers, the water will enter two coagulation basins each 406 ft. x 330 ft. The working capacity of each basin will be 15,000,000 gal. and the basins will be operated in parallel. The manner of entrance and egress of the water will be the same as in the clarifiers except that the gates will be spaced on 40-ft. instead of 30-ft. centers. The velocity of the water through the basin at a 55 mgd. rate will be 0.396 ft. per minute and the detention period will be 13 hours. It is expected that the turbidity of the water leaving these basins will not exceed 5 parts per million.

Chemical Feed.—All of the chemicals will be prepared in the coagulant house and the solutions will flow by gravity to the mixing conduit. The chemicals will be weighed in Richardson automatic scales which will dump at set periods on to a moving belt. The speed of the belt and the time of dumping will be so controlled that a steady stream of coagulant will be fed into the dissolving boxes. The lime will be fed into slaking tanks similar to the ones now in use at the Chain of Rocks. All chemicals will be unloaded and placed in storage by means of a vacuum system.

The water will flow from the coagulation basins to the carbon dioxide charging basin, 110 ft. long, 41 ft. wide and 18 ft. deep, with a baffle running through the basin. The method of distributing the carbon dioxide has as yet not been decided upon. The working capacity of the basin will be 533,000 gal., the velocity about 15.6 ft. per minute and the detention period 14 minutes 10 seconds at 55 m.g.d. The carbon dioxide will be obtained from the flue gas, bituminous coal being the fuel employed.

From the carbon dioxide charging basin, the water will pass through a secondary rapid mixing conduit similar to the one already described except that the length of travel and velocity will be slightly less. The aluminum sulphate will be added as the water enters this conduit.

Secondary Coagulation Basin.—From the mixing conduit, the water will flow through the secondary coagulation basin, 90 ft. long, 159 ft. wide, with 7 baffles 70 ft. long making channels 19 ft. wide. The velocity at 55 m.g.d. with the channels operated in series will be 0.37 ft. per second and the detention period 32 minutes. The aluminum sulphate will be thoroughly mixed with the water in the mixing conduit and the slower flow with the gentle mixing accomplished by the around the end baffles for over half an hour should yield maximum results. The basin is so arranged that the channels may be used in parallel or may be by-passed. The time that the water will remain in this basin precludes any sedimentation so that the amount of turbidity and aluminum sulphate must be at a minimum.

The Filters.—The water leaving the secondary coagulation basin will pass on to 20 filters, each of 4 m.g.d. capacity. These filters will be quite different than those at the old plant. Instead of having a central trough, separating the filters into halves, the filters will have a trough on both ends. Two sewer and two influent valves will be necessary for each filter. Instead of the ridge block with bronze strainer as installed at the old plant, the strainer system will consist of cast iron pipe spaced 1 ft. on centers, 50 to a filter. The pipe varies from 4 in. at the center to 3 in. at the end, welded so as to make a smooth joint. The size of the holes in the pipe is 3-8 in. The effluent pipe varies from 8 in. at the back of the filter to 2 ft. 9 in. at the discharge end.

There will be 18 in. of graded gravel and 20 in. of sand over the manifold. The effective size of the sand will be 0.42-0.47 mm. and the uniformity coefficient not to exceed 1.65. Instead of river sand graded in the filter as was used at the Chain of Rocks, graded Ottawa sand will be used.

The height of the water over the sand will be approximately 8 ft. so that the filters will rarely operate under negative head.

Chlorine will be added to the effluent, the chlorine being measured by Wallace-Tiernan pedestal type machines, the cylinders being placed on chloroscales which will record the amount of chlorine being used.

New Development for Increasing Efficiency of Old Plant.—The following are improvements or new developments

to increase the efficiency of the old plant:

The shore intake offers the great advantage of being accessible at all times and there is no long tunnel to construct and to be filled with sand and gravel when in service. At times of ice trouble, when the river is full of floating ice, it is impossible to get to the intakes at the Chain of Rocks and we do not feel justified in maintaining the number of men at the tower that are needed when real ice trouble is experienced. Means of taking care of any trouble experienced in an intake are readily available at a shore intake.

The primary clarifiers will remove not only the sand as is done in a grit chamber, but will also remove the greater part of the mud with the added advantage of continuously removing the mud from the clarifier with a minimum of water waste and the settling capacity of the clarifier not reduced by solid and floating mud.

The mixing conduit with its rounded turns and high velocity should insure a thorough mixing of the chemicals with the water and thus leave much less work to be done in the circular mixing tanks. The flow in the tanks will not be violent but sufficient turbulence will be created to allow good floc formation.

The slotted openings into the basin will yield much better results than the openings in the weirs as at the Chain of Rocks. The slots are nearly one-half the depth of the basin and with the expected equal distribution of the water through the slots and the depth of water in motion, the detention period of the water in the basin should approach the theoretical detention.

The sludge removed from the secondary clarifiers will be used to hasten the reaction of the chemicals added to the water and some will be added to the raw water entering the primary clarifiers. A more thorough action should result and a saving in chemicals should be effected.

The carbonation of the water will eliminate the coating on the filter sand and also stop the deposition of coating upon the service pipes throughout the city.

The filter sand at the Chain of Rocks is Mississippi River sand graded in the filters. As a result of this method of grading, the effective size of the sand in the various filters varied from 0.31 to 0.45 mm. The sand in the filters being graded sand at the new plant, there should be but little variation in the size.

The greater positive head that will be available at the new plant will enable the filters to be operated without the packing and breaking of the filter bed due to filtering at considerable negative head.

The cast iron pipe manifold strainers and the tapered underdrain should give a much better distribution of the wash water than is obtained with the ridge block strainers at the old plant. Trouble from broken U bolts, loose strainers and clogged holes in the strainer plates is considerable.

The filters will be equipped with a device that will permit the opening of the controller valve to any desired rate in any time up to one hour. From a great many experiments made at the Chain of Rocks we found that by this means the amount of turbid water passing the filter after washing will be considerably reduced.

The large storage provided, 100,000,000 gal., will make it possible to operate the plant continuously at the same rate and thus avoid the disturbing influences of frequent changes of rate.

Contractor Pays City for Park Fill

It is unusual for a city to get any of its park development work done for nothing. Still more unusual is it for contractors to come hat in hand to the city authorities and offer to pay them for the privilege of helping to build a park. That seems to be what is happening just now along the Hudson River waterfront north of Seventy-second Street, in New York City. The city wanted this land filled in and saw its opportunity in connection with the excavation of the Eighth Avenue subway. It arranged with the contractors, who were naturally glad to have so handy a dump, to cart their rock and dirt to the river front. Apparently they did not pay very much attention to grading. Mountains were built here and there, not particularly serviceable for ultimate park purposes, and chasms intervened with no fill at all.

Now the engineers of the Board of Transportation have entered into a new contract with these singular terms: instead of the city paying to fill in and level off the newly made land, the contractor is to pay the city $60,000 for the privilege. He is counting on getting his money back from all manner of individuals who have been doing a little excavating on their own. The arrangement appears to be that these private excavators will pay the general contractor fifty cents a truckload for the privilege of dumping their dirt on the river bank. Out of that sum he will pay thirty cents to the city. The remaining twenty cents is expected to cover his profits and the cost of having the filled-in land graded in accordance with the plans and specifications of the Park Department.

The present undertaking is limited to the work of filling in and grading. Once that is done, the Park Department will carry on with the scheme for beautification. Eventually the development of this section of the waterfront must be harmonized with the general west side improvement plan, which is moving slowly forward. Before he went to Houston Mayor Walker, in response to emphatic public demand, appointed a committee to give proper consideration to the architectural and landscape features of the project. Among its members are Park Commissioner Herrick and such recognized authorities as Joseph H. Freedlander, architect, and Herman W. Merkel, the landscape architect who recently drew up the plans for rehabilitation of Central Park. This committee, the engineering committee and the various city departments concerned will all have a hand in the ultimate solution of the west side problem, so long delayed.—New York Times.

City Sweepers Organize

Election of officers and trustees, and the appointment of committees on organization featured the first regular meeting of the newly founded Drivers, Sweepers, Hostlers, Stablemen and Section Station Keepers Benevolent Association, Inc., composed of workers in the Department of Street Cleaning, at Pearl Mansion, 98 Forsyth Street, New York City.

Officers elected for one year are: John Nacero, President; Jacob Abrams, Vice President; Gerardo Guglielmo, Financial Secretary; David S. Noe, Recording Secretary; Harry Yudenfrient, Treasurer.

Pasquale Sturccio, Angelo Marabella and Ferdinando Ragonese are Trustees, with Jack Casaccio, Sergeant at Arms.

Thomas R. Fitzgerald, a former department employee, set forth the aims of the new organization. He demanded a return of the eight hour day, asked for a maximum requirement of twenty years of service for pension eligibility, with yearly reports and representation of the workers on the pension board, and suggested a clearer definition of the duties of street cleaners.

Other speakers were Morris Echenbaum and Jacob Kusch, organizers of the new body.

Regular meetings will be held on the first and third Sundays of the month.

Creation of Tree Board Proposed

Establishment of a shade tree commission for West Orange, N. J., was advocated by the Planning Commission to the Town Commission at a recent meeting of the Commission. The planning board said the necessity for the unit was emphasized by the ignoring of recommendations to plant trees in many developments.

Mayor Rollinson declared the Planning Commission is already over-burdened and it is too much to charge it with the responsibility of shade trees. The Planning Commission, through its secretary, Frank Jay Morris, declared only one developer has given cognizance to suggestions about tree planting.

The Economic Side of Sewage Disposal

Paper Presented at Iowa Sewage Treatment Conference

By N. T. VEATCH
Black & Veatch, Consulting Engineers

THERE may be a question on the part of some as to whether or not sewage disposal has an economic side, especially to water works operators. The fact that in a large majority of cases, sewage disposal is carried on as a non-revenue producing utility, and in fact generally requires continual outlay for operating costs, repairs, etc., has no doubt had a tendency to give the general public the impression that it is a necessary evil, to be borne in the easiest way possible. Generally speaking, little if any thought has been given to the economic side of sewage disposal. The purpose of this paper is to outline in the brief time available, some of the pertinent facts in regard to the present status of sewage disposal in the United States and Canada, and to show reasons why the subject should receive more thoughtful consideration on the part of the general public.

Sewage Disposal Vital Matter.—In considering the economic side of the average utility, it is possible to make estimates, and later definite statements, showing the operating expenses, revenue obtained, etc., and thus show an economic value expressed in dollars and cents. In the case of sewage disposal, with a few exceptions, such as the sale of purified sewage for irrigation, sale of sludge for fertilizer, etc., which exceptions will be covered more in detail later in this paper, there is no revenue with which to offset operating and fixed charges, and it necessary to justify the expense of both first cost and operation in some other manner. That the question of sewage disposal is a very large and vital matter is plain when the following general data are considered.

In the first place 52 per cent of the entire population of the United States in 1920 was urban. In 1900 this figure was 39 per cent. There can be little question that the majority of urban over rural will continue to increase. As the cities grow, their sanitation problems become more complicated and expensive.

Our larger cities, generally speaking, have realized and are realizing the necessity of properly disposing of their sewage and industrial wastes. Millions of dollars have been, and will be spent, in a large number of our leading cities. Chicago, Milwaukee, Baltimore, Columbus and others are outstanding examples of cities that are meeting the question of sewage disposal in a broad and comprehensive way.

$100,000,000 Invested in Treatment Plants.—It is difficult to even estimate the total investment in disposal works in the United States, as the type of plant will differ in almost every city. It is not as simple a matter as, for instance, estimating the total value in dollars and cents, of the total number of water filter plants in this country. The costs vary some in different localities, of course, but a figure of the value per million gallons of installed capacity could be made, which would be accurate within reasonable limits.

In this case of sewage disposal, there are two distinct degrees of purification, namely primary and secondary, and there are several types of plants for accomplishing each. Partial or primary treatment can be accomplished better in one locality with one type of plant, and better elsewhere with another. This is also true with these cities where complete purification is required. Therefore it is impossible to estimate accurately the amount of money invested in this country for the disposal of sewage, wastes, etc.

An investigation of some 80 disposal plants for which accurate cost data were available, and correcting for difference between pre-war and present costs, and which plants are serving cities ranging in size from 1,500 to 50,000 population, gave average per capita costs of $4.37 for primary treatment, and $10.43 for complete treatment. These figures should be given very little weight, as the costs of the primary treatment plants varied from $1.46 to $8.70 per capita, and those for complete treatment from $4.44 to $19.50 per capita. Metcalf and Eddy in 1915 estimated that 41,800,000 persons were served by sewerage systems and that the sewage of about 84 per cent of this population was disposed of by dilution. This would give a population of 6,700,000 persons, whose sewage was being treated in disposal plants. Since 1915, hundreds of small cities, and a number of large ones have installed disposal plants. It is probable that at least 65,000,000 persons reside in cities served by sewer systems at this time, and that the sewage from at least 20 per cent of that number is treated at disposal works. Therefore it is safe to assume that sewage from at least 12,000,000 persons is receiving some sort of treatment. It is probable that this figure is too low. There are no authentic data as to the relative number of plants using partial treatment, and those using complete treatment.

It seems entirely reasonable to assume that there is at this time a total investment in this country for sewage disposal works, of at least $100,000,000, and probably quite a little more. At any rate this vast sum of money already invested, and the large sums already contemplated for plants throughout the country should, it seems, be ample proof that sewage disposal should at least have an economic side.

Economic Reasons for Disposal Plants.—As stated above the fact that sewage disposal plants are in the large majority of cases non-revenue producing, makes the building of such plants difficult, as the average taxpayer fails to see the need of the benefits to be derived from such a plant. Even though there is no visible return in most cases from the operation of disposal plants, it is quite evident that such vast sums of money that have been spent for such plants, would not have been spent if there were no economic reason for it.

Probably the most active influence in getting disposal plants installed, has been the work of the United States Department of Public Health, and the different state boards of health. Their efforts have have been entirely that of protecting public health. About 75 per cent of the present urban population of the United States is served with water supplies taken from surface supplies such as rivers, lakes and artificial reservoirs.

It is patent that to protect the health of those using these surface supplies, the supplies must be kept as pure and safe as possible. Water purification has and will continue to be the last trench, so to speak, in the protection of public health, so far as water supply is concerned, but in a large number of cases, it is impossible for the water purification plants to assume the entire load.

In the fall of 1917, the aggregate amount of water used by Kansas municipalities along the Verdigris River was approximately three times the flow of the river at the Oklahoma state line. Without the help from sewage disposal plants, it would have been impossible to furnish safe water supplies for those cities. Considerable has been said and written about the economic value of a human life, and the art of water purification has been given great credit for reduced death rates, and it is just that it should. The value of pure water has even been expressed in dollars and cents, based on its effect in the death rates from water borne diseases. Isn't it proper that sewage disposal should

receive its just share of this appraisement, for it is the "front line trench" in the process of keeping our surface water supplies safe for human use.

Broader Aspects of Sewage Disposal.—Sewage disposal should be considered in its broader aspect, which includes trade and industrial wastes, in addition to sanitary sewage. These wastes in a large number of cases are much more serious from the standpoint of stream pollution than domestic sewage, and as our cities grow and industries discharging undesirable wastes into the streams and water courses of the country, increase in number the situation will become more and more difficult.

There are a number of cases where streams have been made utterly useless for human use by the discharge of industrial wastes into them. There are several localities where the discharge of oil well wastes with their accompanying large amount of salt water have actually ruined a large number of public water supplies. In these cases sewage disposal in its broader sense undoubtedly presents an economic problem. In a good many cases it would be cheaper for the different oil companies, causing the pollution of a stream used for public water supply, to develop new supplies for the cities affected, rather than go to the expense necessary to abate the trouble. No one would think of curtailing the development of any oil field or burdening any industry in order to avoid stream pollution, and in some cases it may be desirable to simply dedicate certain streams as outlets for their wastes.

In the past a large part of the burden of disposing of industrial wastes has fallen upon the municipality. This may or may not be economically fair. If the industry or industries contribute, through taxes, a share of the expense that is in proportion to the amount of waste contributed, such a plan is equitable, but if not, it is an injustice. Often the mingling of trade wastes with the domestic sewage makes the purification of the combined sewage more difficult and expensive. Creamery wastes constitute a good example, where the quantity is any appreciable amount of the total. There is a marked tendency on the part of most modern industries to co-operate with municipalities, in connection with disposal of their wastes, and many have taken care of their own problems of disposal either in whole or in part, before discharging them into either public sewers or streams. Surely the proper solution of any such problem is an economic study, and one that can be expressed in dollars and cents.

What might be termed the most potent influence in causing cities and industries to care for their sewage and wastes, is the actual experience or possibility of damage suits. Our court records contain many cases where riparian owners have collected damages on account of the discharge of untreated sewage or wastes into streams or water courses. In some cases it may be possible to buy riparian rights, and avoid the installation of disposal plants, but usually there would be no limit, practically to the distance down stream that it would be necessary to acquire rights, or satisfy owners in some way. In cases where cities or industries are threatened with law suits, it is often easy to justify the cost of disposal plants on account of the probability of their total cost being less than would have to be paid out in damages.

Revenue from Sewage Treatment Plants.—In addition to the economic side of sewage disposal taken by and large, so to speak, there is also an economic side to the art itself. While there are no records indicating that any disposal plant is self-supporting, in the same way as a number of our other utilities, there are a number of examples where some revenue is obtained. Probably one of the best examples is at Milwaukee. The disposal of sludge from any plant has been, and continues to be, the most difficult feature of sewage disposal, and the larger the plant the more difficult the problem.

The American farmer has not been enthusiastic about sewage sludge as a fertilizer. This is, no doubt, due to the fact that few plants have been able to prepare the sludge in such condition that the farmer cares to handle it, much less to pay for it. Also the average sewage sludge without conditioning with other ingredients, particularly phosphoric acid and potash, will not give results comparable with a number of commercial fertilizers. By far the largest majority of plants are glad to give the sludge away to anyone willing to haul it.

In Germany, particularly, the farmers have become accustomed to the use of sludge in spite of the fact it has a low fertilizing value, and is delivered to them with a high moisture content. The time may come when our people will be willing to utilize the value of the many tons of sludge produced each day in this country. Several cities in the United States have tried to handle the sludge on a commercial basis, but have had very little success, and most of them are now glad to give it away. Milwaukee has recently installed a very modern sawage disposal plant, one of the most interesting features being the arrangement for handling the sludge. The part of the plant devoted to sludge disposal is an industry in itself. The sludge is treated in filter presses and driers, and is conditioned with other ingredients to make it desirable as a fertilizer. If the sale of this prepared sludge will only equal the cost of preparing it, the effort is justified, as the most difficult part of the disposal problem will be taken care of without a loss. The amount of sludge from the large number of smaller disposal plants would not justify the cost of preparation as a fertilizer, and usually can be handled by lagooning or drying on porous drying beds.

There are several plants where effluent is used for irrigation, with a resultant return from crops, or fruit, or from the sale of the effluent as irrigation water. At Pomona, Cal., there is a disposal plant serving the three cities, with a combined population of about 20,000, the effluent from which is sold under contract for irrigation water at a price that will pay the yearly operating costs.

The collection of sludge digestion gas is receiving considerable attention on the part of those interested in the art of sewage disposal.

Utilization of Gas.—The gas obtainable can be used for any commercial purpose. The amount of gas obtained depends upon the handling of the sludge digestion, the quantities apparently ranging from 0.3 to 0.5 per foot per capita day. At Decatur, Ill., gas collected from Imhoff tanks is used for heating and laboratory work at the plant, and it was at one time considered as fuel for internal combustion engines for driving compressors for use in activated sludge tanks. It is understood that the amount of gas produced per day averages about 100,000 cu. ft. Sludge digestion gas has a heat value comparable to that of artificial gas and in some cases as high as some of the natural gas supplies. It appears that the collection and use of gas from sludge digestion will play an important part in future design of sewage disposal plants. It is being used in several places as fuel in heating systems used to keep a high maintained temperature in the digestion tanks or compartments, with the possibility of reducing the space required for digestion.

There is evidence that the public is gradually developing a clearer understanding of the necessity for sewage disposal. A number of states have enacted drastic laws governing the pollution of streams. This last year Michigan passed a law, enabling cities to assess charges for sewer services, thus creating an operating revenue. These and many other signs of an awakening public conscience so far as the prevention of stream pollution, and avoiding of nuisance due to the discharge of untreated sewage into our water courses.

There is a somewhat dark side to the subject of sewage disposal, which is definitely an economic one. There are first of all a large number of plants throughout the country that are not designed properly, and cannot give best results, but what is worse is the great number of plants that receive little or no attention. Undoubtedly the investment represented by the plants that are receiving improper, if any, care would reach an enormous sum, and frankly represent wasted investments.

Salvaging Old Surfaces With Bituminous Macadam

Expenses in Texas in Constructing New Wearing Course

By T. E. HUFFMAN
County Engineer, Laredo, Tex.

IN these days of increasing destructive wear on the earlier types of gravel and water bound macadam wearing surfaces in Texas, the highway engineer and public official is every day confronted with the question: What is to become of the old gravel or macadam surface? There was a time when it was considered advisable to tear up and entirely discard them, but today this practice, in the light of the experience of a number of projects in the state, is looked upon as a regrettable waste of public funds. Many hundreds of miles of these lighter types of wearing surfaces were built in the state, during the earlier development of the present highway system, according to designs and under conditions that answered very well for the kind and volume of traffic then in existence, but which are now entirely inadequate for the present day traffic. What follows is intended to set forth, in a brief way, methods that have been followed in salvaging these old surfaces.

We have found that one of the most satisfactory methods for utilizing all of the salvage value of these old surfaces to be the incorporating of them into a base and constructing thereon a bituminous macadam wearing surface. The above type of wearing surface possesses many virtues which recommend its use for this purpose; it is a comparatively low cost wearing surface, where crushed stone is available within a reasonable distance; it adapts itself to any slight movement that may take place in what may be termed an unstable base, such as one composed of gravel or crushed stone; it is not difficult to construct, requiring no large amount of complicated plant equipment; it also provides a non-skid surface for traffic during both wet and dry weather.

Conditions for Resurfacing Old Gravel or Macadam.—An old gravel or macadam pavement, to make a satisfactory foundation for bituminous macadam wearing surface, should fulfill the following conditions:

(1) It should be well drained.

(2) It should be thoroughly compacted.

(3) It should have an adequate thickness and width.

Thickness.—In determining the thickness, impact must not be forgotten. During our school days we learned in physics that the inertia of a sufficient mass would overcome and prevent the transmission of an impulse. The importance of this principle as applied to the relationship between impact and thickness, or mass, in highway paving design can be pictured clearly in our minds by recalling the old mesmeric trick that used to be employed in the theaters whereby the victim was supported by two chairs, his head resting on one and his feet on the other. A heavy stone was placed upon his chest and the stone was then broken with a full swing of a large sledge hammer. It is quite evident what should have happened to the man if the heavy stone had not been over his chest; the mass absorbed the impact and saved the man. This is a rather unscientific way of expressing the importance of securing proper thickness in base design, but it at least serves to exemplify its needs in a clear and impressive manner.

When subsoil and drainage conditions are satisfactory, a bituminous macadam surface may ordinarily be constructed on 8 to 10 in. of old macadam or gravel. A careful study of subsoil and drainage conditions should always be made and care taken that the base is not designed thinner than theory and good practice demands. Either the direct or one of the contributory causes for nearly all failures of penetration roads usually can be traced to weak bases.

Widening Old Pavements.—In most cases the old surfaces are too narrow and the reconstructed pavements will have to be widened to safely care for the increasing traffic of the day. This can be done by adding new metal to each side of the old surface by the use of the trenched-in method. A number of examples are to be found in the East where, in salvaging old surfaces, the widening has been done by constructing concrete lanes on either side of the salvaged surface. In general, this type of widening has been considered good practice, especially as the appearance of the surface of the concrete lanes contrasts with the black center portion of asphalt and secures the desired separation of the traffic lanes. In all cases of widening of this character in the East it has been found that the concrete lanes should be approximately 42 in. in width, in no case less than 36 in. It has been the observation there that the 42-in. strip is sufficient in width for fast as well as for slow vehicles to keep their right hand wheels centered on the concrete strip and avoid concentrating the traffic in one place, causing the pavement to rut. The high cost of this method of widening, of course, would prohibit its use in this state except where the traffic demands were very great.

Costs.—Bituminous macadam costs from $8,000 to $14,000 per mile, and will generally carry from 1,500 to 2,500 vehicles per day. The annual cost of maintenance is reported to run from $200 to $300 per mile.

Salvaging the Old Gravel Surface on State Highway No. 2 in Webb County.—Thirty-three miles of State Highway No. 2, Laredo-San Antonio road, in Webb County—originally a 15-ft. width gravel-surfaced road—was salvaged in 1924 by increasing the thickness and width of the gravel and constructing thereon a bituminous macadam wearing surface with a compacted thickness of 2.5 in. and a width of 16 ft. The old gravel surface was widened to 18 ft. by trenching in an 18-in. width of new gravel on each side of the old surface. To this gravel surface was then added sufficient new material to increase the compacted thickness to a minimum of 8 in. The actual completed thickness of the constructed base varied from 8 to 12 in. On this base was spread a course of 2.5-in. to 1.25-in. trap rock at the rate of 1 cu. yd. in volume to 11.7 sq. yd. of surface. After shaping and rolling this course an application of hot asphalt, at the rate of 1.55 gal. per square yard, was sprayed over the surface; followed by spreading the intermediate course of crushed stone, which in this case consisted of limestone graded from 1.25 in. to 0.75 in., and was spread at the rate of 1 cu. yd. in volume to 55 sq. yd. of surface. After the intermediate rock was uniformly spread, broomed into the voids and rolled, an application of 0.5 gal. of hot asphalt per square yard was sprayed over this surface. The chatts of 0.75-in. to 0.25-in. sized limestone was then cast over this surface, broomed into the voids and the whole surface thoroughly rolled and the road opened to traffic. Continued rolling at this point will improve the pavement. Even after the road has been under traffic for some time an occasional rolling will improve the riding surface. The asphalt specified for this work was an 85 to 100 penetration oil asphalt. The average cost of the bituminous macadam surface was $7,321.86 per mile for

a 16-ft. width, or 78 ct. per square yard. This road has now been under traffic almost four years and the cost of maintenance has been practically nothing. There has been some settling of fills, particularly around bridge approaches, causing depressions in the surface. These depressions were built up with new materials, during the past winter, and this constitutes about the only maintenance expenditures on the surface course of this road since it was constructed. The cost of maintenance has amounted to only a few hundred dollars on the whole 33 miles of surface. The road is in good condition at present, although it is believed that it would be in the interest of good economy to give the surface a light seal coat to consist of about 0.30 gal. of a high penetration asphalt and about 1 cu. yd. of cover material to 100 sq. yd. of pavement surface. The surface should then need very little attention for several years.

Forms for Bituminous Macadam.—It has been our experience that the use of temporary form boards, or any type of side forms requiring removal after completion of the pavement, are impractical and should not be used in the construction of a bituminous macadam surface course. It is very difficult to compact the outside edges of the pavement properly where heavy plank forms are used, and impossible to remove the forms later without injury to the edges of the pavement. Only permanent forms, which will remain in place and become a part of the finished construction, should be used for this type of wearing surface.

On all of our work by far the best results have been obtained by constructing the shoulders before starting the bituminous macadam work, and then using the shoulders as forms for the bituminous macadam construction. The inside edges of the shoulders should be well lined and, where gravel is being used, left a little higher than the grade of the pavement edges. The bituminous macadam work is now carried on between the two shoulder courses, and the last application of the bituminous material is applied with one spray nozzle lapping over on the gravel shoulder; then, after adding the cover material, the pavement and shoulders are rolled as one surface. By this method the bituminous macadam gradually merges into the gravel shoulders without the tendency to leave a plane of weakness between the two surfaces.

If proper care is taken to bring the base course to the required grade and cross-section, no more difficulty is encountered in securing a good finished surface by this method than with the use of temporary forms. In fact, the finished surface presents a better appearance where the methods of construction above are used.

Spreading and Rolling the Coarse Aggregate.—Text books and standard specifications frequently call attention to the necessity of rolling the coarse aggregate until a thorough "mechanical bond" is secured. This is a splendid theory, but I have never been able to carry it out in practice. It may be that there is a crushed stone product in some parts of the United States, passing a 2.50-in. screen and retained on a 1.25 or 1.50-in. screen, that can be mechanically bonded by dry rolling, but I have never been able to find any Texas crushed stone with this characteristic.

Our best results have been secured by carefully spreading the coarse aggregate and then rolling it just enough, preferably with a light roller of from 3 to 5 tons capacity, to compact the course and give it a good cross-section. In this way very little of the stone is crushed under the roller and the course is left open, giving an opportunity to secure a good, even penetration of the bituminous material. It has been our experience that too much rolling, at this time, may do considerable damage; particularly where the pavement is being constructed on a gravel base. The use of hand rakes or coke forks is of considerable value in securing a good spread and an even surface for this course.

Just before beginning the application of the bituminous material to any section it should be given a final inspection to see that all parts of the course are open and that there are no spots showing a segregation of the finer material, dirt or other foreign matter. This course must be clean, uniformly open and of a porous structure to secure the best penetration of the bituminous material.

Application of Bituminous Material.—The bituminous material should be applied to the aggregate only when it is dry and the atmospheric temperature is above 50° F. Care should be exercised to see that the coarse aggregate is disturbed as little as possible during the application of the bituminous material. We encountered considerable difficulty in preventing the rear wheels of the distributor from forming ruts as it passed over the dry aggregate. Most of the rutting is caused by the tractive action of the rear driving wheels and if it becomes serious the trouble can be alleviated by having the distributor pulled over the dry coarse aggregate with the roller. If the ruts are only slight they can usually be removed with the intermediate aggregate, during the application of the second course.

On the Webb County work 85 to 100 penetration asphalt was used. We found this grade of asphalt should be brought to a temperature of around 325° F. to secure the best penetration of the material. It was found practically impossible to secure this high temperature by the use of ordinary heating methods, and a stationary super-heater was installed which gave excellent results and speeded up the work from 25 to 50 per cent.

The super-heater arrangement was very simple and worked perfectly. It consisted of installing a horizontal oil-field boiler along the unloading track and connecting it with the railroad tank car, after the tank car had been spotted opposite the boiler. Steam was then passed through the steam coils in the tank car until the asphalt was sufficiently liquefied to permit pumping. The material was then by-passed through the flues of the boiler and back again to the tank car until the proper distributing temperature was reached. After the asphalt in the tank car was raised to a sufficiently high temperature to permit pumping through the super-heater the temperature could then be "boosted" to 325° F. and from 50 to 60 minutes. The material could then be easily maintained at that temperature by keeping a slow fire in the fire box of the boiler. The super-heater was equipped with an accurate stationary thermometer so that the temperature could be easily regulated, and any danger of overheating or scorchng prevented. Two boilers are required for a plant of this nature; one to generate steam for the initial heating of the asphalt in the tank car and the other to use for the super-heater.

Some Observations on the Pavement After Being Over Three Years Under Traffic.—During the progress of the Webb County work several experimental sections of this type of pavement were constructed, using different combinations of materials. The standard section consisted of crushed trap rock for the coarse aggregate and crushed limestone for the intermediate and fine aggregate. The experimental sections were constructed with the following combinations:

(1) A section using limestone aggregate throughout.

(2) A section using trap rock aggregate throughout.

(3) A section to the surface of which was added a second seal coat; using about 0.20 gal. of bituminous material to the square yard and 1 cu. yd. of fine aggregate to 150 sq. yd. of surface.

(4) A section using the regular course of crushed trap rock and the first application of bituminous material, but, instead of using the intermediate course of crushed rock followed by the seal coat of bituminous material and chats, the base course was bonded and sealed with natural limestone rock asphalt.

(5) A standard section, except that the regular seal coat was omitted and the surface was sealed with natural limestone rock asphalt.

All of the above sections, so far, are standing up under traffic very well. It will take considerable more time to determine definitely any particular merit any one combination may have over the others. Experimental section

No. 3, in which a double seal coat was used, has pretty well demonstrated that a double seal coat is worth while. The extra seal coat adds very little additional cost to the pavement, but it gives the surface a better appearance, adds considerable to its wearing value and increases the imperviousness of the pavement against the leakage of storm water into the base course.

Experimental sections 4 and 5, where the natural limestone rock asphalt was used for the top course, has been watched with considerable interest. These two sections are showing up very well. They have a good appearing surface and show practically no wearing effects from traffic. These two sections are only about 150 ft. long, but it is believed that a combination of this kind might be developed into a good type of pavement, and it would be interesting to see a project of this type of pavement constructed. So far, there does not appear to be any difference in the wearing value of sections 4 and 5 and very little difference in their appearance. It would therefore seem that a choice between these two types would depend upon their respective costs.

During the construction of the pavement, traffic was permitted on the road after the intermediate aggregate was spread and rolled and before the seal coat was applied. Some times the section was under traffic four or five weeks before the seal coat was placed, the only exception being about a 3 mile section of the road where the traffic was detoured until the entire pavement was completed. This section when completed, presented the smoothest and best appearing surface of any other part of the road, but contrary to expectations, it is now probably the roughest section of any other part of the road.

General Observations.—Too much intermediate aggregate should not be applied after the first application of bituminous material; just enough to get the roller over it without picking up any of the material. Roll until the course is thoroughly compacted, feeding in the material as needed but avoid choking.

Care should be taken in keeping the cover stone uniformly applied. This can be accomplished by the proper use of brooms; both hand brooms and rotary sweepers. If an excess of screenings is allowed to segregate at different places on the surface, the excess material will later be whipped away, in spots, by traffic, causing "pot holes" to form in the pavement.

It is a perculiarity of a bituminous macadam pavement that an excess of any of the materials entering into its construction must be avoided. An excess generally causes more trouble than not enough. The reverse is true when it comes to rolling and observing the small details of construction. After the application of the intermediate aggregate it is not believed that too much rolling can be done.

Personally, I much prefer letting the contract for bituminous macadam on the volume instead of the square yard basis. If the contract is let on the cubic yard basis for the aggregate and the gallon basis for the bituminous material it gives the engineer more latitude—without injury to either of the contracting parties—in varying the quantities of materials to meet any changing conditions that may occur on the work from day to day. In this type of pavement, where the component materials are mixed in place, one finds it frequently desirable to make slight changes in the unit quantities of materials used in order to secure the best results.

Where the contract for applying the asphalt is let on the gallonage basis we prefer to base the payment for this item on the heated volume of the material measured just before beginning the application. This permits the measurement to be made at the point of delivery on the road and encourages the contractor to maintain the material at the proper temperature. The volume increase of the material between the normal and application temperature is about 10 percent.

When Salvage Value of the Road May Be of Minor Consideration.—In cases where the old road is poorly located or the horizontal and vertical curves are sharp and dangerous to traffic, the road should be relocated or the curves redesigned without consideration of the salvage value of the old road bed. Roads constructed 10 to 15 years ago were frequently located without proper vision of their future use. It is difficult to estimate the cost to the traveling public of a year's time in rounding a "square turn" on a road over the cost of making the same turn on a reasonable radius. Many of the earlier roads were poorly located not so much from the lack of engineering conception as from a lack of stamina or common ordinary "backbone" either on the part of the engineer or that of the governing body by whom the engineer was employed. Right-of-way difficulties form one of the most unpleasant features connected with highway work. But since the location is about the only real permanent engineering feature of a highway, effecting an accelerated saving in maintenance costs, and in time, money and safety to the traveling public, and at the same time it is one of the features most easily and quickly observed and apreciated by the traveling public, it is therefore believed that salvaging the surface of an old road should be a secondary consideration when the alignment and safety of a highway can be improved by a relocation of the road. It is bad enough to have made the original construction on a bad location, but certainly worse engineering judgement to perpetuate the poor location by constructing a higher type pavement upon it.

Acknowledgment.—The foregoing is a paper presented at the fourth (1928) annual short course in highway engineering at College Station, Texas.

Graham Brothers New 6-Cylinder Truck

Among the features of a new 1¾-ton 6-cylinder truck, recently announced by Graham Brothers, which appeal to contractors are the increased power and flexibility and the greater operating ease and safety provided by the new six cylinder power plant, eleven inch single plate clutch, four speed heavy duty truck transmission and Lockheed hydraulic internal expanding brakes operating in 16 inch drums in all four wheels.

The new 6-cylinder engine has a bore and stroke of 3⅜ x 3⅞ inches and displacement of 207.99 cu. in. The crankshaft is machined all over and is supported on seven main bearings having a combined projected area of 24.15 sq. in.

A temperature indicator is provided in the instrument panel and a thermostat automatically controls the temperature of the cooling water in the cylinder jackets radiator shutter makes it possible for the driver to warm the engine up more quickly and to keep the engine warm when the truck is left standing. Both are said to contribute to the high mileage obtained from the fuel.

The new 1¾-ton chassis is available in two wheelbases, 150 in. for bodies with 10-foot loading space and 165 in. for bodies with 12-foot loading space. The cab has been re-designed to afford greater comfort and better vision. The seat backs are of sedan construction and both back and seat cushions are deeper and more comfortable. The corner posts are of steel to provide slenderness and strength and the windshield is of one piece construction and equipped with an automatic wiper. The cab throughout furnishes ample evidence that the designers realize full well the importance of driver comfort.

One and three-fourths-ton model is only of the complete line of six cylinder trucks recently announced by Graham Brothers, the truck manufacturing division of Dodge Brothers, Inc. The capacities range from ½ ton to 2½ tons and bodies are offered to supply almost every conceivable hauling need. All capacities are fitted with four wheel brakes and all but the two smaller models, the Merchants Express and the Commercial Truck, have four speed transmissions. All have hand brakes operating on drums on the propeller shaft. The hand brake drums on the 1¾ and the 2½ ton models employ 8 inch drums with bands 3 in. wide.

Taxation and Public Improvements

Committee Report Presented to American Association of Engineers

By V. BERNARD SIEMS

Chairman, Committee on Public Improvements and the Tax Rate

THE object of this committee is to devise a model plan by means of which adherence to economic and comprehensive programs of local public improvements may be obtained for local tax-paying publics. Correlative to this general object is the necessity of also devising a model financial plan capable of supporting the improvements plan and of formulating recommendations for a type of administrative policy by which the rights of tax-paying publics will receive just recognition, expenditure of public funds guaranteed for the public good, and control of economic programs assured for their ultimate fulfillment without major deviation or without suffering other detrimental, such as political or social influences.

The preoccupation of business men and engineers with their own affairs, their consequent unwillingness to enter public office, or rather to accept the unpleasantness of political campaigns, and the apparent want of an activating interest on the part of other civic leaders and bodies keeps the ability and standards of municipal officers at a low level and holds open the high standard barriers to political prospectors and the public's exploiters.

Lack of Stability of Conditions.—This very lack of stability of conditions surounding public officialdom destroys any unity of purpose or adherence to a fixed purpose. Public officials who are in office to practice politics see no further than the end of their term of office in providing public improvements and handling the public money.

Thus the conditions surrounding public officials make difficult the adherence to any one program of improvements beyond one term of office and hence the expenditure of public funds economically for the public good.

Any program of public improvements that is to be really beneficial must extend through a period of time longer than the few years of term of the public officials administrations. In many cases local boards or commissions have been appointed and given jurisdiction over the expenditure of improvement funds. Such is a step in the rigth direction since those bodies function for the entire period of the public improvement program and can thus in a general way follow through a single comprehensive schedule of work. Those bodies do, to a great measure, safeguard public funds also and being interested third parties, by virtue of their position, accomplish a more or less economic utilization of the public funds and resources. But that plan is by no means perfect. In most such cases those bodies are appointed by the political party in power, and hence are influenced by and submit to the administration's policy. Examples can be found of such policies not reacting to the general public good.

Such conditions while not ideal can only be accepted as a product of liberal democracy of government. Consequently as these conditions cannot be changed, the duty of devising ways and means to accomplish the public good under such conditions devolves upon those persons or bodies sincerely interested in the public welfare.

Technical Advice Needed.—But again those public spirited individuals or civic bodies though activated by proper motives and earnest in their desire to benefit their communities are without sound locally dis-interested technical advice when undertaking or contemplating a program of engineering improvements. Our association through the work of this committee undertakes to discover a concrete means by which this lacking technical advice may become available and in a form that may be readily adapted to varying local conditions of finance and government.

This work is by no means easy to accomplish. We anticipate the necessity of preceding this, which may be looked upon at first as undesirable outside meddling, or certainly may be so called by a local political press, with an extensive educational program. Our effort might well be in accompaniment with the work now being forwarded by the National Municipal League, whose progress in municipal advancements has been far-reaching though not, to our belief, sufficiently broad.

Our position must also at the start be that of the minority representive. While democratic elections of public administrators reflect the will of the majority, they do not always represent best judgment for the public good. The popular office holder may not be the logical administrator to guide his community through a program of improvements. Political disinterest and public interest is required for the economic utilization of improvement funds and to place those improvements upon a long term schedule, secure adherence to such schedules, devise bases of taxation and plan financing that will be unaffected by political pressure, or change in political administrations.

But no finished plan can result immediately. We must first produce a skeleton work, sufficiently flexible in application to be amendable to local conditions, as our foundation for the more complete plan to follow.

This plan may then be fostered by our Association, published and advertised among civic bodies or the public at large as available technical advise at the call of public officials.

Our first avenue of investigation became taxation. Experience at once pointed out that taxation to provide public improvements has too many times lead to political manipulation of revenue with tax rate.

Public improvements are universally in demand. Reasonable investment of the public's money in them must be measured by the usual standard of value over the cost and a proper amount of return realized by taxation gauged to retire the public indebtedness on time. Advantage should be taken, therefore, of the increased value of a community through expansion and growth in population in order to justify the capitalization of such increased value in additional public improvements.

In this consideration of valuation of communities, the smaller political unit has usually been seen only as a part of the larger county or state unit and the taxing progress for revenue prorated according to divers rules. It is daily becoming more evident, however, that the individual communities should enjoy and be allowed to govern itself. Home rules offers one avenue leading towards the solution of taxation for capitalization.

Property Assessment Methods Must Be Revised.—And, considering the local taxation problem, we are led to believe that property assessment methods must be revised, made logical, equal in application, and positive. The tax schedule possessing these qualities, presupposes, first, accurate knowledge of the cost of government and improvements and the amount of revenue required.

In out treatment, however, it has been thought advisable to dispose of taxation first since in any program the expenditure must logically be budgeted to come within the logical and possible amount of money available to spend.

It is unnecessary for one to search the experiences of many cities to discover that most assessors do not know

how or why to assess. Consequently assessments are inconsistent, inequal, illogical and finally uncertain. Reform in assessment methods is necesary. Happily some progress has been made in this direction.

Assessors Should Be Technical Men.—Of a certainty, assessors should be technical men, but how many have such training. It is almost the rule that assessorships are jobs for the politically proficient, and may remain so in large measure.

If technically trained men are not to be assessors, then technical men should devise the valuation schedule to be applied in assessments. Logical, equal and certain valuation and assessments cannot be made by any hit or miss methods.

Land values and valuations of buildings and improvements by class must be equalized; a suitable record flat system inaugurated; the universal unit of value determined and applied to such records, and a guide systems, to values, from transfers, deeds, mortgages, rentals, salable price, put in operation.

Such scientific methods can only result to the public benefit by making sure and increasing the valuation of public holdings and by virtue of the same certainty as well as total worth ensuring higher credit.

More Attention Given to Scientific Assessing.—As stated, we have found that progress has been made along these lines. The National Municipal Review reports that the present trend of property taxation shows that more attenion is being given to modern and scientific assessing methods. One hundred per cent valuation basis is being approached by many and used by some municipalities, and also, more consideration is being given to the basis for taxation that was outlined in the Model System of State and Local Taxation, by the National Tax Association in 1919. But rather than be over-optimistic we must also admit that even where the 100 per cent valuation basis is operating, exemptions are growing and the Detroit Bureau of Governmental Research reporting the statistics of 176 cities investigated found no increase in tax rate for 1927 over that for 1926 though 53 cents over that for 1925. Yet this may mean that through proper assessment revenues have been increased with the same tax rate in force. If so, some cities will have already experienced the profit of scientific assessment over haphazard ones.

Under taxation we have here considered first, property taxation as being most interesting to the engineer and most in need of adjustment and possible of more ready local revision.

Both Personal Income and Business Taxation add to available revenue, but because of the more general aspect of these sources they do not materially affect local taxation for improvements.

The Struggle Between Executive and Legislative Rule.—Causes of failure in methods of administration have been discussed in the opening paragraphs of this report. Success in the work before us depends upon the ability to overcome the handicaps developing out of the struggle between executive and legislative rule, which schism divides responsibility, causes duplication of function with consequent inefficiency in administration and wasteful utilization of public revenue.

The Budget System was offered, and sometimes accepted, as a means of placing responsibility of the accounting of public expenditures, and likewise of planning for future improvements. But there is not yet universal recognition of or adherence to this means of checking efficient administration or of guarding against political extravagances. Credit should be freely given to the National Municipal League as a champion of this much needed reform, the outcome of which has been the acceptance, by a growing number of communities, of the City Manager or Commission Manager Plan. The acceptance of this plan of administration is always over strong opposition and often after established has been subject to further test at the polls, referendum, and sometimes defeated, by adherents to the principle of thorough-going and direct popular control, so called.

Budget System a Requisite.—A Budget System is generally recognized as a requisite to any reorganization in administration. It is a popular means of detailing necessary public works and their expense. Of course the value of the annual or term budget depends upon the degree of care exercised and its construction. Our work lies here in fool-proofing the budget procedure and its correlated premises.

Knowing the revenue available, the budget must comprehend a complete and thorough program of work and improvements. It should be well balanced, investment and expense against return and revenue. Major projects or activities should be itemized for although the operating head may be proficient, the public should know in advance how its money is to be spent. Procedure should be established to ensure proper expenditure of the funds for the purposes intended in the budget. This may be accomplished by providing a means of authorizing the incurrence of liabilities. Control over the rate of expenditure is also important, which may be accomplished by accounting statements at regular short intervals.

What the Improvement Should Cover.—A clear picture of the end in view in providing public improvements should be had before any attempt is made to secure adherence to a plan or to devise its financing. The improvements should cover all of the municipal or state activities in order to give a balanced program and usually would include utilities, streets, parks, buildings and zoning, public safety. None of these five major features of government should be slighted. Expenditures should be allotted intelligently to distribute the available fund relatively equally depending upon honest need of improvement in each. A clear picture of the ultimate end in view must be had in order that the program may be comprehensive and conservative of effort and expenditure. Thus each successive improvement should be in sequence and directed towards ultimate realization of the entire program, to ensure an economic and orderly progress.

Next, knowing the fund available through taxation, and having budgeted this in accordance with a thorough and comprehensive plan of improvements, the financial plan by which such an improvement program may be fulfilled must be devised.

Financing Permanent Improvements.—It is common to finance permanent improvements through the issuance of bonds, or special assessments usually liquidated in installments which necessitates issuance of bonds to provide money during construction. We do not consider here, any but permanent improvements as the public should not incur debt for any other except, perhaps, in dire emergencies of floods, etc. The terms of the bonds should be limited to the life of the improvements covered by them. This is not always adhered to and bonds are found unpaid on public improvements that have already outlived their usefulness or disappeared. Such a condition though would be corrected by following a proper plan for improvements. Sinking funds and reserves should be maintained to retire term bonds. However, serial bonds are usually preferable to term bonds in smaller communities. In large communities the market and stability of the issue would govern.

The bond term should not be too long; difference in annual costs do not justify assuming long interest burdens. Bond costs depend upon the amount of bond, rate of interest and time of maturity. Serial and term costs, therefore, are equal if the sinking funds earn the same interest carried by the bond. If the sinking funds earn higher, the term bond is cheaper unless the market should be unfavorable to that type at time of sale.

Bonds should provide capital expenditures. Recurring capital outlays such as extensions of utility services, etc., should be financed annually from current revenue.

Qualified Personnel Essential.—To carry out our plans of providing for and obtaining economic public improvements, a qualified personnel should be insured. Modern and thorough going civil service should be instituted, salaries standardized, by a schedule proportional to the value of the public holdings, thus to attract efficient technical workers and to properly protect them from political interference. The public, in proportion to its property value, should enjoy every technical serv-

ice it can afford. The personnel giving this service should be paid according to its responsibilities as determined by the value of the improvements and it should be free to devote its entire energy to the work in hand. Many valuable technical men are underpaid by municipalities because force of circumstances holds such men to their jobs. Municipalities would profit through class of service by paying professional rates of salary to professional men. Many cities suffer from the loss of service of capable public employees felled by the political axe. Recent examples are found in the action of Chicago, and Baltimore, in discharging technical men of national repute. No comprehensive plan can be carried out by or even entrusted to incapable civic employees. No matter how able the plan, those who are to work under it must likewise be able or it can only fail.

Finally, any plan designed for action must have a leader. By natural tendency of our publics, there are usually several well defined groups of opinion regarding any contemplated civic activity or local improvement. If this association is to formulate and present this plan of providing public improvements it might also provide a clearing house for these opposed views or the means of correlating its and the efforts of local civic bodies to this end. A local congress of such bodies might be suggested as the activating council charged with the furtherance of needed legislation for the purpose of properly developing local communities and for city and state planning.

This committee, therefore, after reviewing the problem and suggesting the avenue leading towards its solution recommends a further study by sub-committees of the six major features outlined above, taxation, Budget System, City Development and Planning, Finance, Civil Service and Public Relations and Legislation. It is better to spend time in study before producing our finished plan than to attempt to promote an ill-advised or incomplete one. Public officials as well as the public are daily learning through the experience of cities and towns. The excellent work and publications under the auspices of the National Municipal League merit thorough review before our final plan is selected. Thus we counsel thoroughness, no haste, wider publication of our present effort, that we may receive aid through the comments of as many members of our association as possible.

Committee Personnel.—The American Association of Engineers Committee consists of the following: E. F. Motsinger, Clarence W. Hubbell, A. R. MacLaren, Chas. S. Keating, James E. Sellers, Gordon E. Ferguson, R. E. Duff, W. Bernard Siems, A. A. Prendergast, Wynn Meredith, J. G. Huckins, Warren B. Keim, R. B. Taplin, and Daniel W. Patton.

$32,000,000 Spent for Municipal Recreation

An expenditure of $32,191,763 for municipal recreation in 1927 as contrasted with $19,200,000 in 1926 and $9,317,000 four years before, is revealed in the annual year book of recreation statistics for the United States and Canada, published by the Playground and Recreation Association of America.

Nearly half the 1927 outlay was for the purchase of land, buildings and permanent equipment, and the remainder was for upkeep and salaries.

Bond issues for recreation in the 5-year period 1923-27 totalled $47,106,648, including $11,960,200 last year. The number of cities reporting recreational facilities under leadership rose from 505 in 1922 to 815 in 1927. Of the latter number, 321 have year round supervision of recreation.

Baseball on public diamonds is falling behind the pace of growth of some other sports. From 1924 to 1927, the number of baseball players doubled, but that of playground ball players nearly tripled and basketball more than tripled. The number of teams in the six most popular municipal sports last year were as follows: Playground ball, 16,129; baseball, 14,676; basketball, 13,052; volley ball, 6,179; horseshoes, 4,901; and soccer, 3,493.

Of more than twenty-five million spectators at municipal sports, fifteen million attended baseball games.

Tennis courts increased by 723 and swimming pools by 147 over the 1926 totals. Enthusiasm for golf hit the municipal pocketbook to the extent of 69 new courses last year. At the same time that municipal golf courses are rapidly increasing, there is an universal need in the cities for children's playgrounds and baseball diamonds, which are not increasing rapidly enough to take care of the child population, according to the Playground and Recreation Association. The lack of baseball diamonds is responsible, in part at least, for the relatively slow growth of baseball as compared with some of the other sports, and the insufficient number of playgrounds helps to account for the increasing death toll of children at play in city streets, says the association.

Model aircraft construction and flying, a new activity on public playgrounds, was reported last year by 138 communities.

Boston, Mass., Increases Water Rates

The city of Boston, Mass., on July 1, advanced its water rates 20 per cent. The new rates are as follows:

	Old Rates (Per. M.)	New Rates (Per M.)
First 20,000 cu. ft.	$1.54	$ 1.84
Second 20,000 cu. ft.	1.43	1.71
Third 20,000 cu. ft. and up to 1,000,000 cu. ft.	1.32	1.58
All over 1,000,000 cu ft.	.88	1.05
Minimum rate	8.80	10.00

Cost of Sewer Construction at Providence, R. I.

The following table from the last annual report of S. Frank Nolan, City Engineer of Providence, R. I., shows the average depth of cut, nature of excavation, and contract cost of labor per foot, on the different sizes of regular sewers built during 1927 have been as follows:

Items.	Average Nature of Excavation	Average Depth of Cut, Ft.	Average Cost per Foot.
6-in. pipe in drains to curb line	Sand, dry	10.50	$ 1.59
6-in. pipe in drains to curb line	Sand, wet	10.50	1.92
6-in. pipe in drains to curb line	Sand and gravel, dry	10.50	1.43
6-in. pipe in drains to curb line	Sand and gravel, wet	10.50	1.62
6-in. pipe in drains to curb line	Hard pan, dry	10.50	1.57
6-in. pipe in drains to curb line	Hard pan, wet	10.50	1.37
6-in. pipe in drains to curb line	Rock	10.50	1.42
8-in. pipe in basin connections	Sand, dry	8.00	1.10
8-in. pipe in basin connections	Sand and gravel, dry	8.00	1.28
8-in. pipe in basin connections	Sand and gravel, wet	8.00	1.00
8-in. pipe in basin connections	Hard pan, dry	8.00	1.26
8-in. pipe in basin connections	Hard pan, wet	8.00	1.14
8-in. pipe in basin connections	Rock	8.00	1.30
8-in. pipe sewer	Sand and gravel, dry	11.67	2.00
12-in. pipe sewer	Sand, dry	12.00	2.47
12-in. pipe sewer	Sand, wet	12.00	4.22
12-in. pipe sewer	Sand and gravel, dry	12.00	2.53
12-in. pipe sewer	Sand and gravel, wet	12.00	3.57
12-in. pipe sewer	Hard pan	12.00	3.02
12-in. pipe sewer	Rock	12.00	3.23
15-in. pipe sewer	Sand and gravel, dry	12.25	2.95
15-in. pipe sewer	Hard pan, wet	12.25	3.22
15-in. pipe sewer	Rock	12.25	3.25
20-in. pipe sewer	Sand and gravel, dry	17.67	6.75
22-in. pipe sewer	Sand and gravel, dry	12.83	4.40
27-in. pipe sewer	Sand and gravel, dry	13.25	2.00
16-in iron pipe sewer	Sand and gravel, wet	12.25	5.00
22-in. circular brick and concrete sewer	Sand and gravel, dry	12.83	5.00
30-in circular brick and concrete sewer	Sand and gravel, dry	13.50	5.00
32-in. circular brick and concrete sewer	Sand and gravel, wet	13.67	5.00
38-in. circular brick and concrete sewer	Filling, dry	14.17	5.50
40-in. circular brick and concrete sewer	Sand, wet	10.00	6.00
42-in. circular brick and concrete sewer	Filling, dry	14.50	6.00
78-in. circular brick and concrete sewer	Sand and gravel, wet	14.50	12.25

Average cost of building manholes, each	$49.55
Average cost of building catch basins, each	50.25
Average cost of building extra inlets, each	11.97
Average contract price for rock excavation per cu. yd.	3.41
Average contract price for brick masonry per cu. yd.	13.50
Average contract price for concrete per cu. yd.	6.60
Average contract price for lumber in foundation per M. ft.	40.00

Recreational Opportunities Provided By City Park Systems

A Summary of the Park Systems of the United States

THE concentration of large populations in comparatively restricted areas, which has been a result of the industrial expansion of the past few decades, has brought with it the problem of providing adequate space and facilities for the recreation of children and adults. The following summary from the July Monthly Labor Review of a recent survey of the county and municipal park systems throughout the country, gives an idea of what has been accomplished by different communities in the provision of park and recreation centers.

Development of the Park Movement.—The park movement in the United States has developed since the middle of the last century, as prior to 1850 no laws had been enacted which provided for park and other recreation systems and not a single municipal department had been specifically created to handle parks and recreation. At the present time there is a multiplicity of agencies throughout the country which are dealing with the question. In the first 25 cities in size, for example, there are 62 different agencies dealing with public parks and public recreation.

The early idea of a park among park builders and planners was that of "a place where urban inhabitants could obtain the recreation coming from peaceful enjoyment of its rural, sylvan, and natural scenery and character." The type of recreation advocated at that time was of a passive or semi-active kind and the dominant ideal was that of peaceful enjoyment amid beautiful surroundings. This concept has changed and widened, however, and provision for a wide range of active forms of recreation have come to be included. The new movement toward the use of parks for active recreation began with the playground movement for children about 1880 and in the following two decades expanded into the general recreation movement for persons of all ages. In addition to changing the functional uses of many park properties, the new movement brought into existence a number of new types, such as areas devoted more or less exclusively to playgrounds, playfields, athletic parks, stadiums, neighborhood recreation parks, swimming and boating centers, golf courses, and boulevards and parkways. The growth in the scope of park activities added to the services of park adminstration agencies a series of complex and difficult social problems involved in organizing for the people a wide range of recreational activities of a physical, cultural, social, and civic nature which necessitate cooperative relationships with other public and private agencies.

At the end, therefore, of nearly three-quarters of a century of park development in the United States, the term "park" has come to mean "any area of land or water set aside for outdoor recreational purposes, whether it be recreation of a passive or an active nature or of any of the degrees between those two extremes, and that 'the recreation is expected to come in part at least from beauty of appearence.'"

Extent of Park Planning.—Growth of city planning in this country has been rapid in the past 20 years. During this time 176 cities, representing about one-fifth of the total population of the country, have had general plans made, including comprehensive park plans. Altogether about 390 cities have legally constituted planning boards which are organized to direct the development of the cities along the best lines. Regional park plans are also either actually in effect or are being worked out in many large cities, and there are 525 cities which have zoning ordinances. The matter of zoning is of fundamental importance in securing the permanency and stability of the properties set aside for parks and recreation centers.

Prior to 1900 there was only one organization dealing with the subject of parks which was national in scope. This association was made up of the executives in charge of the comparatively few park systems in existence at that time. About 1917 the society was reorganized into the American Institute of Park Executives and American Park Society. The Playground and Recreation Association of America was formed about 1905.

The provision of special courses in schools and colleges for the training of park executives and recreation leaders is comparatively recent, although at the present time there are more than 60 colleges and universities giving special courses for park executives, with special attention to landscape design and the propagation of trees, flowers, etc., while there are about 140 educational institutions providing courses for the training of playground leaders, and there is one national graduate school for the training of recreation executives.

Present Park Areas.—It was not until about 1890 that the real movement toward the provision of parks by municipalities began. Between 1852, when there was not a single municipal park in the country, and 1892, provision for municipal parks was made by only 100 cities; while 10 years later, 796 cities were known to have made a beginning toward providing parks. In 1925 and 1926, approximately 1,680 cities had provided nearly 250,000 acres of recreation spaces.

Although this would seem to indicate that rather remarkable progress in park planning had been made, in reality the situation is not so satisfactory as it appears.

New York City, with nearly 6,000,000 people, has only about 10,000 acres set aside for play, sports, and all other forms of outdoor recreation for children and young people and for adults. Practically the same thing is true also, of Chicago, which, with approximately 3,000,000 inhabitants, has less than 5,000 acres of public property set aside for the recreation of the residents. A great outlying section, however, has been developed which can be reached by trolley and antomobiles. This is the Cook County Forest Preserve which contains about 31,600 acres, the development of which represents one of the most notable civic achievements of any American city, exceeding, probably, anything done in any city of the world in recent times.

In the vicinity of New York City, other agencies than the city have provided areas which can easily be used by the residents. The most important of these is the great Westchester County Park System which was not started until 1922 but for which an expenditure of nearly $37,000,000 had been authorized by the end of 1926. The park now comprises more than 16,000 acres. Residents of New York City also have access to the Palisades Interstate Park in the States of New York and New Jersey which totals 37,190 acres and extends for several miles along the Hudson River. This park provides facilities for bathing, boating, camping, hiking, etc., and has been developed with the sole object of making it readily accessible for the people of the nearby cities.

Among the largest cities of the country, Philadelphia has the best showing as to ratio of park acreage to population, as with a population of less than 2,000,000 it has almost 8,000 acres of park properties, practically all of which are within the city limits. Although the city has no regional park plan under way there is one being outlined which will probably be developed

within the next few years. Some of the smaller cities, as might be expected, have a larger ratio of park acreage to population than the large cities. Minneapolis, with aproximately 14 per cent of the area of the city in park property and a ratio of 1 acre of parks to every 80 inhabitants, leads all cities of more than 100,000 population except Denver and Dallas, in both of which, however, a large part of the park acreages lies outside the city limits. Kansas City, Mo., has a ratio of 1 acre to every 100 inhabitants; Los Angeles and Portland, Ore., 1 to 118; Indianapolis, 1 to 122; and Washington, D. C., 1 to 128. In all these cities there is a lack of children's playgrounds and neighborhood playfield parks, which is due to the failure to plan for such spaces before the residential sections were built up.

A comparison of the cities of the country, grouped according to the United States census population figures, with the reports received of the park acreage in these cities shows that all these groups of cities are still far from being adequately provided with parks. In the group having populations from 100,000 to 250,000 there are only six that have a park acreage that gives them a ratio of 1 acre to every 100 persons or less and of the 73 cities having populations of from 50,000 to 100,000, only 16 equal this ratio, while many fall very far below it. Of 1,321 villages with a population of less than 2,500 reporting on their local park situation, 57 per cent stated that they had no parks, while a similar condition was found among communities with populations ranging from 2,500 to 5,000.

The ratio of park acreage to population which has been used as the simplest measure of the extent to which the cities are providing recreation areas does not furnish an accurate measurement, however, as the park system may be inadequate if most of the total acreage is in one large park, if the parks are so distributed that they are not readily accessible or if they do not provide a variety of recreation facilities.

The limited number of communities under 5,000 population reporting parks is indicative of the lack of play facilities in numerous small towns, villages, and rural districts. Millions of people living in these localities have no park or playground facilities. Space is not lacking, as there are always open fields and vacant lots, but these are entirely inadequate for recreation without proper equipment and competent leadership. Twenty per cent of the communities in the population group 5,000 to 10,000 reported no parks, although like the smaller towns such places as school yards and vacant lots may be used in part for recreation. The total park acreage of 50 typical cities of the population group 10,000 to 25,000 is several times as great as that of Baltimore, Boston, or St. Louis, each of which has a population equivalent to that of this group of smaller places. There are 324 park properties in these cities as compared with 66 in Baltimore, 99 in Boston, and 96 in St. Louis.

One hundred and thirty-three of the cities in the group of 25,000 to 50,000 population reported parks, but 20 of these cities had 45 per cent of the total park acreage. In these 20 there is an average of 1 acre of park to every 53 inhabitants. There is the same inequality in park development found among the cities ranging in population from 50,000 to 100,000.

In the large cities, those having 250,000 inhabitants or more there seems to be no special relation between park planning and city growth while in the nine cities which have from 500,000 to 1,000,000 inhabitants there is decidedly less park acreage in proportion to the population than in most of the smaller cities. These cities are especially lacking in children's playgrounds and neighborhood parks, yet every one of these communities has a planning commission and a more or less comprehensive scheme for the extension and development of the park system. The area in parks in the three largest cities—New York, Chicago, and Philadelphia—is smaller in proportion to the population than any one of the groups of cities from 25,000 inhabitants upward.

Detailed examples of some of the park recreation systems of the different cities, such as those of Minneapolis, Spokane, Houston, and Pasadena, show admirable types of park development from the standpoint of number of acres, types and distribution of properties, character of development, and quality of maintenance.

Municipal Parks Outside City Limits and County Park Systems.—The extension of the park systems beyond the limits of the city has been made possible by the widespread ownership of the automobile. Through this improvement in the means of transportation a city recreation system may be extended many miles into the country and still be used by large numbers of people. Park properties have been acquired outside the city limits by about 100 cities. The largest city park outside the city limits is owned by Phoenix, Ariz., and comprises 15,080 acres in one property while Denver owns more than 10,000 acres in mountain parks. The purchase of park areas outside the city limits is a wise procedure, moreover, because of the probability that such areas will be greatly needed as the city develops.

The first county park system to be established was that of Essex County, N. J., which was started in 1895. Although the plan was extremely successful the idea spread slowly and few such systems were started before 1920. Since that time, however, a number of county park systems have been started in different sections of the country and there are now 33 counties which have one or more county parks with a total area of 67,464.71 acres.

Under certain conditions, the report states, counties are "admirably adapted to park planning and they offer an undeveloped field of tremendous importance in the general outdoor recreation movement. Although many of the outstanding county park systems have been designed as units for handling metropolitan park problems, it is conceivable that the greatest field of usefulness of this type of system will be in providing recreation opportunities for the rural districts and the people in the thousands of small municipalities throughout the country."

Recreation Facilities in Parks.—The most significant trend in the municipal park movement in the last 25 years has been the use of parks for active recreation. While the use of parks for active games and sports was opposed at first by most park executives and commissioners, today at least 90 per cent of those in charge of parks favor their use for active recreation, as well as rest and reflection.

The place of children's playgrounds in a park system is indicated by the fact that 309 cities reported 4,819 playgrounds located in parks. The park recreation facilities reported most frequently were areas for baseball, football, soccer, playground ball, horseshoe pitching, basket ball, field hockey, track, field events, volley ball, hand ball, and croquet. Ninety-eight cities reported golf courses in parks. Among the other sports for which facilities are provided are bowling, roque, polo, archery, and shooting. Wading and swimming pools, bathing beaches, and boating facilities are common, and in the northern sections of the country the various winter sports are provided for.

The municipal parks are also the centers for a wide range of social, recreational, and educational features; many of them contain clubhouses, gymnasiums, and field houses and thus serve as community centers. Art galleries, museums, outdoor theatres, band stands, and conservatories located in the parks add to the cultural and educational life of the people, while purely recreational buildings and structures include boathouses, grandstands, bathhouses, and dancing pavilions. Zoological gardens were reported by 99 cities. Facilities for picnics reported by 117 cities are part of the movement to encourage outdoor activities on the part of families and community groups.

Park Finances.—Considerably over $1,000,000,000 is the estimated amount of capital invested in parks at the present time, while the operation and maintenance expense of these parks is in excess of $100,000,000 per year.

The financing of park systems falls into two distinct divisions, covering the

acquisition and permanent improvement of properties and the operation and maintenance of the parks. Various methods are followed in financing the purchase and permanent improvement of these properties. These include: Use of current funds of the park and recreation department or by direct appropriation of a municipal or county government; the sale of bonds secured by general taxation, by special assessments, or by a combination of these methods; installment payments out of the net proceeds obtained from the operation of the particular project itself; proceeds from gifts, bequests, etc.; and the acquisition of properties through use of the principle of excess condemnation or excess purchase. Acquisition and improvement may also be financed out of current revenues, although on the whole this has been found to be an undesirable method.

The revenues from the operation of recreation facilities include the lump sums which may be paid for concessions or the fees paid for the use of certain types of recreation facilities. These fees are charged usually on the theory that the patrons of a given facility should pay for the operation and maintenance where the general public had provided the capital outlay and also because the opportunities provided are valued more if paid for than when they are free.

Early Examples of Town Planning in the United States.—As early as 1565, when the Spaniards founded Santa Fe, a square or plaza was set aside in the center of the town for a public square which still serves the public as a center for the social, political, and recreational life of the city. This plan, which was followed by the Spanish builders of towns in the South and Southwest, influenced the plans of such cities as San Francisco and Sacramento. while the English colonists on the Atlantic coast followed the custom of setting aside spaces for town commons, the most notable example being the Boston Common. In other cities, notably Philadelphia and Savannah, the city plans provided for the reservation at regular intervals of spaces for the use of the public, while in Washington a combination plan of rectangular and radial streets provides numerous open spaces. These and other plans for setting aside spaces for community use were in general forgotten or discarded in the century which saw the rise and expansion of modern industry and commerce.

Obstacles to Town Planning.—One of the principal causes of the failure to follow a consistent policy in the development of American towns and cities has been the difficulty in democratically governed communities of securing unity of mind upon a given policy or plan. Another reason was the rapidity with which the population of the country changed from a rural to a predominantly urban population and the general failure to understand the significance of the change which was taking place or to plan wisely for the changing living conditions, while a further obstacle to the development of a proper park policy has been the prevalence of rural ideas and ideals under urban conditions and in urban communities. In spite of the fact that more than half of the population is located in the cities, rural individualism still controls to a large extent, because the "peculiar political condition whereby State governments exercise considerable control over laws affecting cities tends to perpetuate rural control even in cities located in States that are largely industrial."

New Power Take-off on Elevating Grader

A chain is only as strong as its weakest link, and an elevating grader is only as efficient as its carrier. The carrier determines the capacity of the machine. The new Austin Power Take-off—a device by means of which the carrier of the Austin "Contractor's Special" New Era Elevating Grader is driven directly from the engine of the "Caterpillar" sixty tractor—not being dependent for its power upon the traction of the rear wheel of the grader—will save time, labor and money, according to the manufacturers.

It provides a faster moving belt, affording greater capacity, as well as a constant, uniform belt speed, irrespective of the movement of the grader as a whole; no delay in delivering dirt.

The drive is positive irrespective of the load put upon the carrier by the plow, avoiding clogging and providing uniform delivery of dirt. Thus the plow may be worked to its full capacity, greatly increasing the capacity of the grader. Work may be started much sooner after a rain than when the carrier gets its power from the rear wheel.

A big saving in gasoline, and wear and tear on the tractor, by reason of the decreased load it has to pull, is made possible by this new method of carrier drive, illustrative by the difference between a six-ton load with one wheel braked until it is nearly locked tight, and the same load with all four wheels running free.

A big saving in repairs to the grader can be realized by reason of the elimination of wear on the drive wheel, short shaft, gears and other driving mechanism between the rear wheel and the carrier.

The very nature of the work for which the Power Take-off was designed makes imperative not only ruggedness, but also the very highest quality of material and workmanship, and no expense has been spared in this connection in order to insure to the user a device that is said to be almost immune to breakage from loads or rough handling.

Adjusting Overrun and Underrun of Aggregate

An interesting account of a sinple test and the resulting adjustment of the amount of stone and gravel used in the mix on a concrete road job in Freestone County, Tex., was given by M. B. Hodges, Resident Engineer, Texas State Highway Department, in a paper presented at the 4th (1928) annual short course in highway engineering at College Station, Tex.

Two paving projects were started at very nearly the same time. One contractor was using, as coarse aggregate, a good quality of washed gravel, while the other was using a good quality of crushed stone. Fine aggregate in both cases was of approved quality and of very nearly the same screen analysis.

An average daily screen analysis of the stone was as follows: 100 per cent passing 2½ in.; 27 per cent retained on 1½ in.; 72 per cent retained on ¾ in.; and 96 per cent retained on ¼ in. This stone met the specifications for coarse aggregate.

An average daily screen analysis of the gravel was as follows: 100 per cent passing 2½ in.; 13 per cent retained on 1½ in.; 52 per cent retained on ¾ in., and 98 per cent retained on ¼ in. This analysis also met the specifications but the gravel contains more fine material than the stone. After work had been started on both projects, it was found that the contractor using the stone was having an overrun in the number of daily batches. This overrun was consistently about 3 per cent. The contractor using the gravel was having an underrun of about the same percentage. These percentages were determined quite accurately. Samples of both types of materials were brought into the office and a crude but effective test was made in the following manner: A quart measure was used and two batches of concrete were made, using the materials in the same proportions as on the job, namely 1:2:3½. Water was added to make a workable and consistent mix and the two batches were measured. The resulting numbers were divided by the total number of quarts originally used and multiplied by 42.25, the number of cubic feet of dry materials which were assumed to be necessary for a cubic yard of concrete. The batch using the gravel resulted in 28.4 cu. ft. while the batch using the stone resulted in 25.4 cu. ft. The mix on the paving job was then adjusted by adding to the stone mix 1 cu. ft. of sand and taking from the gravel mix 1 cu. ft. of sand. After this adjustment had been made, the mix checked out very nicely, so long as the screen analyses of the gravel showed the same average grading as that used in the above test. The gravel mix also checked out correctly.

Program of Forty-Seventh Annual Convention of the New England Water Works Association

Papers That Will Be Presented at Montreal Convention

THE 47th annual convention of the New England Water Works Association will be held in the Windsor Hotel, Montreal, P. Q. Canada, September 18, 19, 20 and 21.

The office of the secretary will be located in the Concourse, on the first floor, Windsor Hotel, and will be open for registration at 3 p. m. Monday, September 17.

Technical Meetings and Exhibits.—The exhibits will be located in the Rose Room and Concourse, first floor, Windsor Hotel; technical sessions in Windsor Hall. Superintendents' sessions on Wednesday will be held either in the Prince of Wales Salon or in the Oak and Blue Rooms. These rooms are adjacent to the Concourse, Rose Room and Windsor Hall.

Immigration Requirements.—The Immigration Regulations pertaining to residents or citizens of the United States who have visited Canada and are returning to the United States are not especially strict, but when returning to the United States all persons are required to prove to the satisfaction of the Immigration Inspector that he is legally entitled to enter.

Citizens who are native born should have a certified copy of their birth certificate. If this cannot be obtained a certificate from the Registrar of Voters of the city or town in which the person votes stating that the person is a voter will be sufficient.

Naturalized citizens should have their naturalization papers. If for any reason these are not available then a certificate from the Registrar of Voters as in the case of native born citizens will be sufficient. These requirements apply to female citizens as well as to male.

Transportation.—Arrangements have been made with the Canadian Pacific Railway to handle reservations in special service. Plans are being made for two special trains from Boston, Monday, September 17—one to leave about 9 a. m., standard time, arriving Montreal 6:30 p. m.—the other to leave 9:30 p. m., arriving Montreal 7:30 a. m. Special N. E. W. W. trains will depend on securing sufficient number to operate, otherwise special cars will be arranged.

Trains will run via Lowell, Manchester, Concord and St. Johnsbury. Connections from all points furnished on request to Canadian Pacific Railway.

Summer tourist round trip fares in effect from all points. The rate Boston to Montreal and return is $21.45. Pullman fares from Boston are as follows: —In each direction, parlor chair, $2.25; lower berth, $3.75; upper, $3; compartment, $10.50; drawing room, $13.75.

Members from New York City and points south may make arrangements for through service to Montreal, with special parlor or sleeping cars, by applying to Mr. E. C. Drake, District Passenger Agent, Grand Trunk Railway System, New York City.

Day trains leave New York, Grand Central Terminal, at 7:35 a. m., arriving Montreal at 9:35 p. m.

Night trains leave New York, Pennsylvania Station, at 8 p. m., arriving Montreal at 8:40 a. m.

Fares from New York to Montreal are as follows:

One way, $14.01; round trip, $22.42.

Parlor chair, in each direction, $3.00; lower berth, $3.75; upper berth, $3.00; compartment, $10.50; drawing room, $13.50.

Program.—The following gives the program as announced by Robert Spurr Weston, chairman of the program committee:

TUESDAY, SEPTEMBER 18
Morning Session, 10 a. m.

Address of Welcome by
His Worship Camillien Houde, Mayor, City of Montreal.

Secretary's Report.

Treasurer's Report.

Editor's Report.

Award of Dexter Brackett Memorial Medal.

Closing of Polls.

Appointment of Tellers.

REPORT OF COMMITTEES ON

Standardization of Cast Iron Pipe and Special Castings, Frank A. McInnes, Consulting Engineer, Chairman.

Simplification of Man-Hole Frames and Covers. Frank A. McInnes, Consulting Engineer, Chairman.

Specifications for Cast Iron Pipe and Special Castings, Frank A. McInnes, Consulting Engineer, Chairman.

Standardization of Pipe Flanges and Fittings, Frank A. McInnes, Consulting Engineer, Chairman.

Code for Pressure Piping, Sectional, Malcolm Pirnie, of Hazen & Whipple, Consulting Engineers, Chairman.

Yields of Catchment Areas, X. H. Goodnough, Chief Engineer, Massachusetts Dept. of Public Health, Chairman.

Painting Standpipes, A. O. Doane, Division Engineer, Metropolitan District Commission, Chairman.

Standardizing the Steps of the Meter Schedule, Arthur E. Blackmer, Superintendent Water Works, Plymouth, Mass., Chairman.

Legislative Matters, Charles W. Sherman of Metcalf & Eddy, Consulting Engineers, Chairman.

Grounding of Currents on House Plumbing to Act in Connection with a Similar Committee of the American Water Works Association, George A. Sampson of Weston & Sampson, Consulting Engineers, Chairman.

Representative at Tests of the Bureau of Standards, Harry W. Clark, Director and Chief Chemist, Massachusetts Dept. of Public Health.

11:30 a. m.

Visit to Plant of Consolidated Pipe Co., Limited, of Montreal. Luncheon provided by the Company.

Afternoon Session, 2 p. m.

Protection of Catchment Areas, John F. Skinner, Assistant City Engineer, in charge of Additional Water Supply, Rochester, N. Y.

Report of Committee on Cement-Lined Pipe, (Illustrated), Robert Spurr Weston, Chairman, of Weston and Sampson, Consulting Engineers, Boston, Mass.

Report of Committee on Cross Connections, Robert Spurr Weston, Chairman, of Weston and Sampson, Consulting Engineers, Boston, Mass. E. Sherman Chase, Secretary, of Metcalf and Eddy, Consulting Engineers, Boston, Mass.

WEDNESDAY, SEPTEMBER 19
Morning Session, 9 a. m.

Unusual Methods of Water Purification, M. E. Flentje, Superintendent of Purification, Community Water Service Co., New York City.

Recent Developments in Water Purification, Wellington Donaldson, Fuller and McClintock, Consulting Engineers, New York City.

The New Water Purification Works at Greenwich, Conn., (Illustrated), E. Sherman Chase of Metcalf and Eddy, Consulting Engineers, Boston, Mass.

Afternoon Session, 2 p. m.

Effect of Sunlight on the Determination of Chlorine by the Ortho-tlodin Method, F. R. McCrumb and W. R. Kenny, of the Research Laboratory of The La Motte Chemical Products Company, Baltimore, Md.

The Equipment and Operation of Water Works Laboratories, Melvin C. Whipple, Asst. Professor of Sanitary Chemistry, Harvard University, Cambridge, Mass.

Zeolite Water Softening for Municipal Supplies (Illustrated), F. D. Kneeland, Chemist Ohio Valley Water Co., McKees Rocks, Penna.

The Extension of the Works of the Greenwich Water Company, Greenwich, Conn. (Illustrated), Dana M. Wood, with Stone and Webster, Engineers, Boston, Mass.

Evening Session, 8 p. m.

The McTavish Street Pumping Station, Charles J. DesBaillets, Chief Engineer, Montreal Water Board, Montreal, Canada.

The Montreal Filtration Works, Frederick E. Field, Division Engineer, Montreal Water Board, Montreal, Canada.

SUPERINTENDENTS' CONFERENCE
WEDNESDAY, SEPTEMBER 19

In Charge of Past President Stephen H. Taylor, Supt., New Bedford, Mass., Water Works.

Morning Session—9 a. m.
Subject—Distribution.
Opened by Paper on "Some Distribution Problems," Fred B. Nelson, Assistant Engineer, Dept. of Water Supply, Gas and Electricity, New York City.
Followed by general discussion.

Afternoon Session—2 p. m.
Opening Subject — "Electrolysis of Water Mains."

Evening Session 8 p. m.
Opening Subject—"The Effect of Flushometer Vales Upon Water Works Practice."

These conferences are informal and any questions which members would like discussed should be sent to Mr. Taylor before the meeting, that time may be reserved for them.

THURSDAY, SEPTEMBER 20TH
Morning Session, 9 A. M.

Factors in the Design of Distribution Systems, V. Bernard Siems, Vice President and Chief Engr., Detwiler and Company, Inc., New York City.

Visit to the Montreal Water Purification Plant. Luncheon provided by courtesy of the City of Montreal. Ladies are cordially invited.

Afternoon Session, 3 P. M.

The Gas Producer Plant for Water Pumping at Manchester, Mass., a Record of Twenty Years, Raymond C. Allen, Civil Engineer, Manchester, Mass.

The Oxy-Acetylene Process in Modern Industry. R. W. Boggs, The Linde Air Products Company, New York City.

Demonstration of the Televox System, the Westinghouse Co., Pittsburgh, Penna.

General Discussion:

Are the Present Specifications Dealing With Fire Hydrants and Valves With Special Reference to Valve Stems Satisfactory? Discussion to be opened by Mr. Frank A. McInnes.

FRIDAY, SEPTEMBER 21ST
Morning Session, 9 A. M.

A New Pipe for Water Mains (Illustrated), R. W. Mitchell, Consulting Engineer, The Asphalto-Concrete Corporation, New York City.

Report of Tellers of Election.

President's Address.

ENTERTAINMENT
TUESDAY, SEPTEMBER 18TH

Informal Reception and Dance at Windsor Hotel. (Courtesy Water Works Manufacturers' Association.)

WEDNESDAY, SEPTEMBER 19TH
(Ladies)

10 a. m. Trip to Mount Royal. (Courtesy of the City of Montreal.)
2:30 p. m. Theatre Party. (Courtesy of the Water Works Manufacturers' Association.)
8 p. m. Ladies' Reception and Bridge, Windsor Hotel. (Courtesy Water Works Manufacturers' Association.)

THURSDAY, SEPTEMBER 20TH

11 a. m. Inspection of the Montreal Water Purification Plant. Luncheon provided (Courtesy of The City of Montreal.)
3 p. m. Shopping Tour for Ladies and Fashion Show. (Courtesy of the Montreal Tourist and Convention Bureau.)
7:30 p. m. Dinner Dance and Entertainment Windsor Hotel. (Courtesy Water Works Manufacturers' Association.)

FRIDAY, SEPTEMBER 21ST

Afternoon—
Especially Arranged River Excursion and Trip Through the Lachine Rapids. Details to be announced at the convention. (Courtesy Water Works Manufacturers' Association.)

Draftsmen Put in Single Bureau

An order placing all the drafting forces of the city under the supervision of William O. Atwood, head of the Bureau of Plans and Surveys, was issued yesterday by Charles F. Goob, Chief Engineer of Baltimore. In a letter to the bureau heads in the Department of Public Works, Mr. Goob said:

"In the preparation of your budget for 1929, where you have loans available, you are directed to set up a sufficient amount of money to reimburse the Bureau of Plans and Surveys for work that is to be done under loans that are appropriated.

"Further, where classified draftsmen are incorporated in your present budget please confer with Mr. Atwood, with the end in view of transferring this personnel to the Bureau of Plans and Surveys.

"It is understood that personnel who are classified engineers and who do designing work are not to be transferred to that bureau."

It was said at the City Hall that the order was in line with Mr. Goob's plan to coordinate all the forces of the Department of Public Works. The bureau budgets for 1929 will be prepared in this way.

It is expected that the salaries of all the bureau heads will be increased to $6,000, to place them on an equality in this respect with Mr. Atwood, Walter G. Hammond, Engineer of Buildings, and others whose pay was increased several months ago by the Board of Estimates, on Mr. Goob's recommendation.

When the Board of Estimates made up the budget for 1928, the salaries of these bureau heads were fixed at $5,000, at the suggestion of Mayor Broening, who had the board standardize that figure.

Park Board Would Supervise Airport

The City Park Commission will administer the East Boston Airport when it is leased by the City of Boston, Mass., if Mayor Nichols can obtain City Council concurrence in an order which he is to present. The commission is composed of W. P. Long, chairman; Charles H. Innes and F. S. Deland.

Lieut. Donald Duke of the Army staff, now operating the airport for the so-called Municipal Air Board, headed by Chairman Gardner Fiske, will continue as superintendent, under the Park Commission's administration of the airport, if Mr. Nichols can persuade the Army authorities at Washington to give Duke leave for this service.

The Mayor will seek an appropriation of about $125,000 of taxpayers' funds, with which to expand and improve the airport, and will soon ask for about $75,000 of this sum. This Fall he hopes to get underway the initial program of installing runways at the airport, of fencing it, and also the big task of properly lighting and grading the plant.

Springfield, Ohio, Approves Bond Issue

Tentative approval of a municipal bond issue amounting to $2,692,000 for improvements in the public schools, City hospital, park system and flood control of Springfield, Ohio, was given recently by a citizens' committee appointed some months ago to draft an improvement program for the city.

The bond issue will be submitted to voters in the November election.

Bucyrus-Erie Shovels Have New Mounting

One of the interesting new developments in excavating machinery for road building and general contracting noted in recent convention exhibits, was the "Single Shaft Drive" caterpillar type mounting for Shovels and Cranes introduced by the Bucyrus-Erie Company, of Erie, Pa.

Since caterpillar type mounting has come to be recognized generally as the most satisfactory for power shovels and cranes, the most important consideration now is to get the continuous-tread mounting in its simplest and most reliable form.

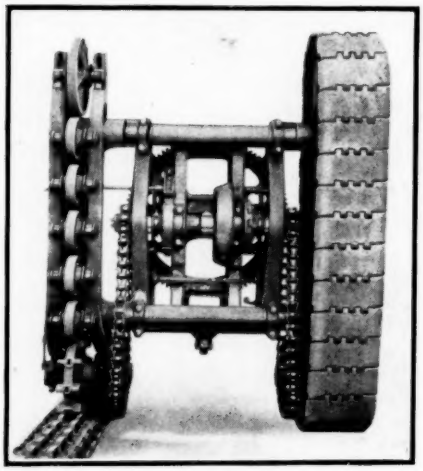
As the new Bucyrus-Erie mounting has fewer parts, extra strength can be built in with no added weight. Besides which, this new mounting combines several unique features that users are finding very valuable in service, according to the manufacturers.

The "Single Shaft Drive" mounting is in the highest degree non-clogging—even when it is shoveled full of dirt, it throws out the material as it moves ahead its own length, it is claimed. The drive chains, which are of hardened forged steel are self-cleaning.

It easily takes grades of 30 per cent, and steeper, say the manufacturers. A two-way brake, which operates with a ratchet effect, allows free movement in either direction as desired, but locks the machine against the digging, or on a grade.

Sharp turns can be made with this mounting as well as gradual turns. It can make either a right angle turn in one spot, or a long radius turn—steering from either end of the treads, with the machine moving either forward or backward, it is said.

Another feature of this mounting is its perfect accessibility for renewing or inspecting parts. Any wearing part of this mounting can be quickly and easily removed without disturbing any other part.

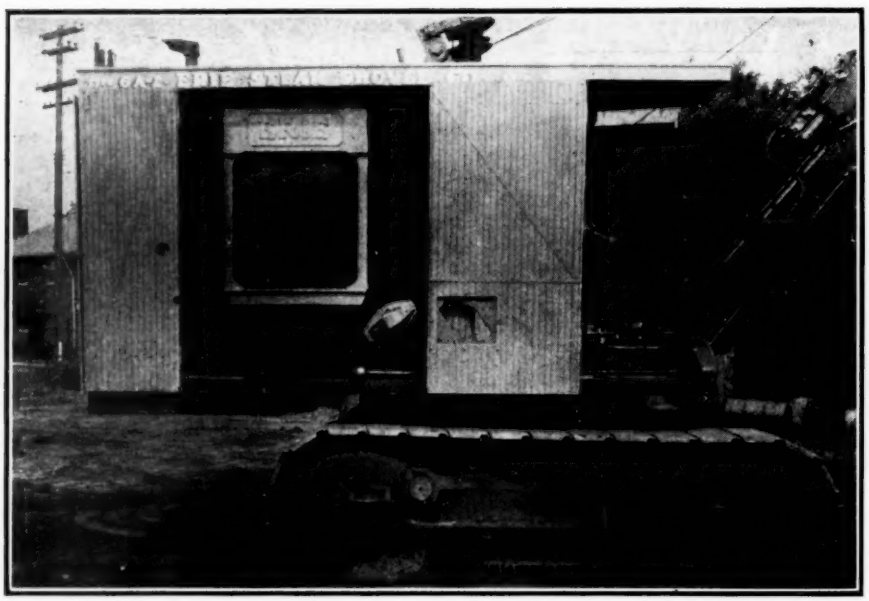


View of the New Mounting, Showing Its Simplicity

With only one drive shaft and gear below the deck, the extreme simplicity is very noticeable. The one gear and its pinion are enclosed, protected against dirt and grit—and operate high above the ground. There is 12-inch clearance underneath; nothing to drag when moving over rough uneven ground.

The truckframe is a one-piece annealed steel casting, 23 inches deep—practically indestructible. Drive shaft splined—no keys. Treads are exceptionally strong, and have 1½ in. hardened steel pins.

All Gas+Air and B-2 Steam Bucyrus-Erie machines are now being furnished with this new mounting as standard equipment. Its simplicity and strength, combined with its performance on many machines which have seen hard service, has shown it to be a meritorious mounting for shovel and crane work, say the manufacturers.



A Bucyrus-Erie Machine Equipped with the New Simple Mounting

Trade Publications

The following trade publications of interest to municipal engineers, waterworks engineers and contractors, sewage engineers and contractors and others in the municipal field, have been received. Copies may be secured upon application to the manufacturers named.

Meters.—National Meter Company, 299 Broadway, New York City, has recently published an interesting little booklet under the title "The High Cost of Low Prices." In this literature they discuss the significance of low prices as being a measure of low value or, in other words, the fixing of a cut price by a manufacturer is but his admission that the goods are not worth the higher price asked for competing merchandise. The purpose of this discussion of prices is to maintain the idea that the above concern is a high-priced house, and that its high prices are justified by the high cost of manufacture and therefore the high value of its meters. The discussion, with a number of significant quotations, is well thought out and carries the idea through to its conclusion in a logical manner.

Trench Pump.—A. S. Marlow, Lincoln Park, N. J., has submitted a bulletin describing the 3 in. and 4 in. single and double "Mud Hog" diaphragm pumps manufactured by them. These pumps are said to be useful for trench work and for pumping out manholes and catch basins, as well as for other and similar duties. The bulletin gives complete specifications for four types of such pumps that they manufacture.

Concrete Pipe, Etc.—Asphalto-Concrete Corporation, 1440 Broadway, New York City, the firm that now controls the patents involved in the Moir-Buchanan process for making concrete pipe, the Bille-Ligonnet process for applying an asphalt lining or surface to concrete pipe or other concrete work, and the Contractor process for making concrete poles and conduits, and who issue rights to manufacture such products under these patents in this country and others, have issued a booklet describing these processes, the advantages accruing from their use, and the possibilities of such products. The booklet, intended to promote further plants and to promote the use of these products, illustrates the processes, the products that result, and a number of successful plants, together with tests that have been performed to investigate the properties of products so made. It makes interesting reading.

Sludge Bed Glass Enclosures.—Lord & Burnham Co., Irvington, N. Y., have distributed a loose-leaf prospectus, specification book and installation list that describes the glass enclosures made by them for sludge beds. The information and illustrations presented in this prospectus on present installations is of interest, while specification data given should prove useful. This literature is bound in an artificial leather cover.

Pumps.—DeLaval Steam Turbine Company, Trenton, N. J., has issued a new bulletin on sewage pumps that contains not only some interesting installation illustrations, but that illustrates and describes as well the features of these pumps that make them of value to the sewage treatment works.

Industrial Notes

The D. C. James Manufacturing Company, Chicago, makers of all types of speed reducers and cut gearing, announce the addition to their sales department of Mr. R. C. Bird, in the capacity of traveling sales manager. Mr. Bird, formerly with the Chain Belt Company of Milwaukee, has spent some twenty years in working with power transmission equipment, and will be available to all interested in securing speed reducers for specialized jobs.

Robbins & Robbins, 801 Tchoupitoulas St., New Orleans, La., have been appointed sales representatives in the states of Louisiana and Mississippi for Graver Corporation, East Chicago, Ind. They will handle Graver's complete line, consisting of water softeners, filters, tanks and steel plate equipment.

Paradon Manufacturing Company, 573 Elm Street, Arlington, N. J., announce the appointment of the Pacific Water Works Supply Co., Inc., Atlantic Street Terminal, Pier A, Seattle, Wash., as their representatives in the sale and servicing of Paradon Chlorinators in the Pacific Northwest. The Chemical Equipment Corporation, 215 West Seventh Street, Los Angeles, Cal., have been appointed in a similar capacity for the States of California, Nevada and Arizona.

The Quigley Furnace Specialties Co., Inc., of New York, manufacturers of Hytempite, Quigley Refractory Gun, Triple-A Solutions, Quigley Acid Proof Cement, etc., announces that Harrison W. Wood has joined their service staff. He will cover the Central South and South Atlantic States. Making his headquarters at Atlanta, Mr. Wood will co-operate with all Quigley agents throughout the Central and South Atlantic States.